# Chemical Engineering

JANUARY 1956

Today's trends in . . .

material resources production costs living standards manpower and how they affect

TECHNOLOGY in the year ahead

A MCGRAW-HILL PUBLICATION

ONE DOLLAR





Push-button operation: Here, high-speed cooling ... automatically controlled ... improves the uniformity of gel. This VOTATOR Continuous Cooling Apparatus drops product temperature in seconds.

#### Results of high-speed heat-transfer by GIRDLER

Here's a sure key to better quality and lower costs in the manufacture of products such as the 24 shown on this page:

Girdler's VOTATOR\* Processing Apparatus continuously heats or cools viscous and liquid materials at rates of six to ten times those of conventional batch methods. This rapid heat transfer, plus simultaneous agitation vastly improves quality control, processing-efficiency and output-rates for a wide range of products and processing functions.

If you manufacture any product involving heat-sensitive or viscous liquids, you cannot afford to overlook this unique processing method! Girdler engineers will gladly advise you on your application. Call our nearest office today.

WOTATOR-Trade-Mark Reg, U. S. Pat. Off.

# The GIRDLER Company A DIVISION OF NATIONAL CYLINDER GAS COMPANY LOUISVILLE 1, KENTUCKY

VOTATOR DIVISION: New York, Atlanta, Chicago, San Francisco

In Canada: Girdler Corporation of Canada Limited, Toronto

## January 1956 GUIDED TOUR

JOHN R. CALLAHAM, EDITOR

#### What's in Store for '56

As you go through this first issue of 1956, you'll see innovations in format and typography.

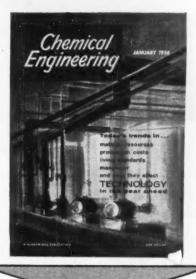
We've made several changes in our cover, for instance. And in this issue we switch over to a neater, more readable body type for all articles and departments. There are format improvements, too, in departments such as Chementator and What's Happening.

These physical changes are all designed to make CE more attractive, easier to read, easier to use.

We also have changes in contents planned for 1956, for it's contents—not appearance—that really make a magazine.

For one thing, we'll publish more articles for the engineer in development and design work. And more on basic principles and engineering theory as these relate to today's practice in industry.

In brief, here's our promise for '56: Close attention to your needs, a real effort to fill them.—JRC



#### How the recent technological advances can affect and effect significant trends.

Our 33rd Annual Review and Forecast evaluates and brings into perspective the most significant technological advances so that trends may be extended into the future. Here you'll find a resume of progress and what the important developments will be in four major areas of technological impact. Don't miss this 16-page roundup. (p. 175)



#### Flexible — literally and figuratively.

Mighty useful, that's what woven wire belts are if you're processing pelletized, slab or sheet solids. They're flexible; resist heat, cold and corrosives; aid gas-solids contacting. Use them to wash, dry, dewater, form, react, cure. (p. 194).



#### A new kingdom: nitroparaffins.

And keys to this new kingdom were the solutions to the many and varied problems that stood between laboratory and commercial production of a new family of chemi-



Please turn page



# Chemical Engineering

JANUARY 1956

cals with a future that's potentially broad and impressively varied. (p. 199)



#### A specific follow-up.

See what can be done with digital computers in a practical situation. Case study reports on how computers save time, money and manpower in solving some heat transfer problems. (p. 203)



#### Tackling the tough ones.

Most industrial reactors are designed for complex reactions where product distribution can be more important than the reactor volume. A new "how to" series starts in your CE Refresher. (p. 207)



#### What's the job outlook in '56?

Expect to be looking for a new job this year? It's our bet that you won't be looking long. There'll be plenty of openings, but don't be surprised if salaries aren't much higher. (p. 226)



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#### CHEMICAL ENGINEERING

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# now you can control your filtration cycle for peak efficiency

The Bird-Prayon Filter's individual pans, coupled with flexible application of feed and wash, pin point the feed slurry and wash liquors at the correct positions in the filtration cycle.

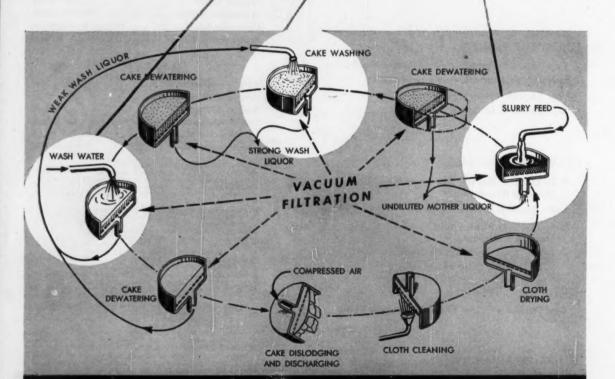
This flexibility means

- maximum capacity
- minimum vacuum requirements
- sharp wash separations
- maximum cake dryness

Let us mail you a new Bulletin containing the whole, remarkable story on this BIRD-PRAYON Filter.

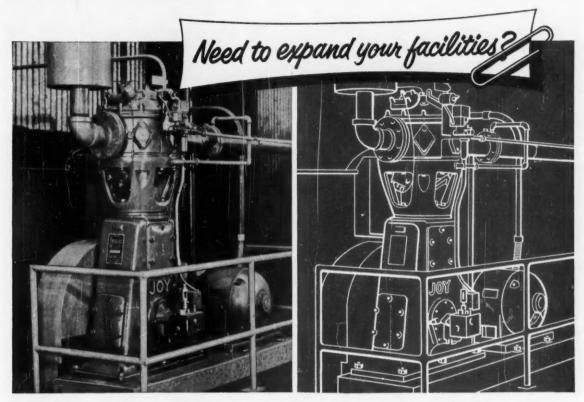
#### BIRD MACHINE COMPANY South Walpole, Massachusetts

al Offices: Evanston, Illinois



This Sketch Brings out One of the Many Advantages of the

BIRD-PRAYON CONTINUOUS ROTARY HORIZONTAL VACUUM



# Add compressed air power efficiently with the JOY WG-9

The Joy WG-9 heavy-duty vertical air compressor is a natural for supplying additional air for an existing system, either centralized or decentralized.

Because of its smooth running characteristics and the small floor area required, the WG-9 needs only a simple, block-type foundation. The average base dimensions of a larger model WG-9, including motor, are 7'1" by 4'1". This means greater capacity per square foot of floor area—42 CFM per square foot on the 100 psi rated machines.

Thus, the WG-9 packs large compressor capacity in a small compressor area. It is possible to install the machine in a central compressor room where unused floor space is at a premium, or in a decentralized plant location where crowding of machinery is a problem.

If you have plans for a small plant, the WG-9 is designed to give you continuous 24-hour heavy-duty service. It is also widely used to meet special requirements in larger operations, such as boosting air above standard plant pressures.

The Joy WG-9 is a water-cooled compressor, available in capacity ranges up to 881 CFM piston displace-

# Consult a Joy Engineer

For Air and Gas Compressors, Oxygen and Nitrogen Generators, Vacuum Pumps and Boosters, Conveyors, Fans, Electrical Connectors, Hydraulic Fittings and Hose Assemblies. ment and in pressures up to 150 psi. Standard drive is multiple V-belt. This machine can be furnished for flat belt or vee flat drive if desired.

#### LARGE COMPRESSOR FEATURES INCORPORATED IN ALL WG-9 SERIES

- Full Force Feed Lubrication
- Joy Patented "Dual-Cushion" Valves
- Anti-friction Main Bearings
- Replaceable Cylinder Liners and Crosshead Guides

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Write for FREE Bulletin 22-11



CHEMICAL ENGINEERING-January 1956

Announcing...
the new,
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GRINNELL-SAUNDERS

STRAIGHTWAY

DIAPHRAGM

VALVE

... the diaphragm valve with
STRAIGHT-THROUGH FLOW,
for handling viscous materials,
fibrous slurries, sludges, pulp
stock, latex, magmas, semi-fluid
foods, solids in suspension,
sewage, water, corrosive chemicals





Diaphragm lifts high for streamline flow in either direction. No pockets to trop sludge



Diaphragm presses tight for positive closure even when handling gritty or fibrous materials

Grinnell-Saunders STRAIGHTWAY Diaphragm Valve\* offers you these exclusive features: the ability to handle viscous materials without restriction or stoppage; minimum pressure drop; rodding or brushing without need of removing bonnet and without possibility of damaging body linings; self-draining when line is pitched sufficiently to drain piping.

Grinnell-Saunders STRAIGHTWAY Diaphragm Valves are available in a range of body, lining and diaphragm materials. Inquiries invited. Bulletin on request.

\*Patented

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Title or function

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# B. F. Goodrich Chemical saw materials



B. F. Goodrich Chemical Company does not make these panels. We supply only the raw materials.

# Rigid vinyl windows beat double trouble

WHAT do you do when windows are attacked from two sides? By corrosive fumes and hot air inside, and outside by the weather. A chemical plant in Texas had the problem and found the answer. In went new translucent panels made from Geon rigid vinyl—out went the old windows and a costly maintenance problem!

Installing the green-tinted corrugated panels was easy—they were simply nailed in place. Because they are made from Geon, they resist sunlight, cold, rain, acids, alkalis,

oil and grease. They are decorative as well as functional.

Products made from Geon rigid vinyl include corrosion-proof pipe, fume ducts, tanks, trays, materials that can be machined, planed, sawed, drilled, and cemented. You'll find other Geon polyvinyl materials in flexible, colorful upholstery, in high-dielectric insulation, in wear-resistant flooring, in hundreds of other successful products.

Geon's remarkable physical and chemical properties may give your products a decisive competitive edge. For technical information, please write Dept. DB-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



GEON RESINS • GOOD-RITE PLASTICIZERS...the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

# There's No Other Welding Tee Like This!

68721 4" SCH. 10S FLOWLINE ,120" WALL 304L

# FEMILESS STEEL, MONEL, NICKEL and ALUMINUM WELDING FITTINGS Preferred for Dependable Corrosion Service

The Welding Fittings organization — recognizing the superiority of welded piping for corrosion service — was the first to standardize, manufacture, and stock a complete line of stainless steel welding fittings.

The tee shown above—typical of all FLOWLINE Welding Fittings—provides unique features that have been developed through long, intensive specialization in design and production of welding fittings for corrosion service.

FLOWLINE fittings—tees, ells, reducers, stub ends, and caps—are available in sizes ½" through 12", in Schedules 5S, 10S, 40S, and 80S.

#### WELDING FITTINGS CORP.

NEW CASTLE, PENNSYLVANIA

W-10

World's Largest Manufacturer of Stainless Welding Fittings

# Features of FLOWLINE Tees

- Cold formed seamless by the exclusive Welding Fittings process.
- Reinforced crotch—tee is stronger than pipe with which it is used.
- Full center to face dimensions.
- Smooth interior walls.
- Ends machine tool cut and finished.
- · Annealed, cleaned bright, passivated.
- Heat number permanently stamped on each tee as record of actual analysis and physical properties.
- Every tee is marked with type of metal, size, schedule, wall thickness, and FLOWLINE trade mark.

January 1956—CHEMICAL ENGINEERING

# HOW TO PICK A FILTER AND BE SURE YOU'RE RIGHT

Consult the Bird
Research and
Development Center
For Recommendations
Based on Pilot-Scale
Tests of Your Material
Before You Invest
in Equipment



Choose from the Complete Range of Modern Solids-Liquids Separating Equipment Built by Bird



THE BIRD SOUD BOWL



THE BIRD
PRESSURE FILTE



THE BIRD-YOUNG CONTINUOUS ROTARY VACUUM FILTER



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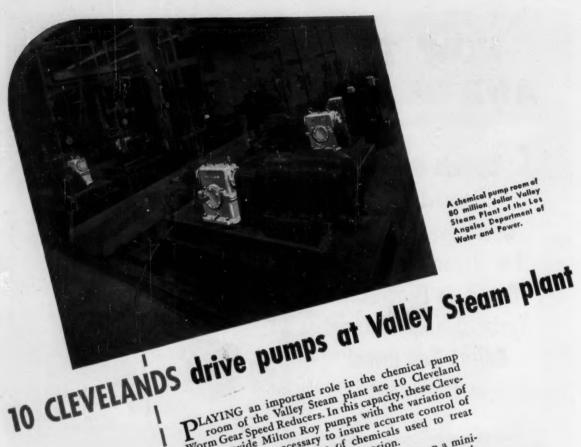
THE BIRD SUSPENDED CENTRIFUGAL



THE BIRD-PRAYON
CONTINUOUS ROTARY
HORIZONTAL
VACUUM FILTER

BIRD MACHINE COMPANY

SOUTH WALPOLE • MASSACHUSETT



A chemical pump roem of 80 million dollar Valley Steam Plant of the Los Angeles Department of Water and Power.

PLAYING an important role in the chemical pump Troom of the Valley Steam plant are 10 Cleveland. Worm Gear Speed Reducers. In this capacity, these Cleve, lands provide Milton Roy pumps with the variation of Worm Gear Speed Reducers. In this capacity, these Cleve-lands provide Milton Roy pumps with the variation of stroking speeds necessary to insure accurate control of proportioning and volume of chemicals used to

stroking speeds necessary to insure accurate control of chemicals used to treat proportioning and volume of chemicals used to treat the water to prevent scale and corrosion. Notice how Cleveland worm gear units take up a mini-mum of space. And nower is transmitted with a spinoph. proportioning and volume of chemicals the water to prevent scale and corrosion. Notice now Cleveland worm gear units take up a minimum of space. And, power is transmitted with a smooth, uniform torque flow. Case-hardened steel worms mesh mum of space. And, power is transmitted with a smooth, uniform torque flow. Case-hardened steel worms mesh with nickel-bronze gears for long, hard, dependable with a smooth, hard, ha

You'll find Clevelands throughout the chemical and allied number agriculture mixers—in fact. You'll find Clevelands throughout the chemical and allied fact, mixers—in fact, agitators, mixers—in driving pumps, agitators, right-angle drive every kind of equipment for which a right-angle driving pumps, agitators, and allied is needed. service without appreciable wear.

If yours is a power transmission problem, you can get the yours is a power transmission problem, you can get the yours is a power transmission problem, you can get the yours is a power transmission problem, you can get the your street. Cleveland 4. Ohio. Street. Cleveland 4. Ohio. is needed.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication.

Affiliate: The Farval Corporation, Brothers Limited. Street, Cleveland 4, Ohio.





# YOU'RE INVITED

to send us a sample of your material

> ... a pound or a ton...

In fully-staffed, modern laboratory, miniature equip-ment is used to test small batches sent to Link-Belt.

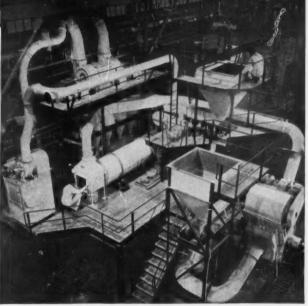
Full-scale facilities are used for large runs. Over 1000 of these tests have been made, on more than 100 products.

#### We'll work out drying, cooling or roasting procedures for you

WHAT'S the best drying, cooling or roasting method for processing your materials? Hundreds of plants throughout the world have found an exact, detailed answer through Link-Belt test runs. Here's how it works:

- You send a representative sample of your product — a pound or a ton — with a complete de-scription . . . covering initial moisture, critical temperatures and your merchandising objec-
- On equipment like that shown above, our specialists conduct test-runs — find how to blend, compound or convert it to desired chemical composition. Our analytical laboratory will determine needed catalyst or agents to be added, if tests so indicate.
- · With probable efficiencies decided, we'll lay out flow charts of methods you can follow in your own plant.

If shipping your product is impractical, we'll gladly set up a pilot unit on loan at your plant. Write or send samples to LINK-BELT COM-PANY, 300 West Pershing Road, Chicago, Ill.





**DRYERS · COOLERS · ROASTERS** 









LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

# 23,896 "Watchdogs" Every Month...

That's the average number of laboratory tests we make each month to insure that every run of every Dicalite product will render uniformly high performance. (The actual number varies, and depends on the different Dicalite products run.)

22 people and 4 laboratories—one in each of the 4 Dicalite processing plants—are needed for this continual quality control. No other mineral, processed into powder form, is so closely controlled as to particle size and surface area. For these are highly important factors in most of Dicalite's many uses, either as filteraid, filler or in other uses.

Hence, the tests continue, lot after lot, recording flow rate, cake density, color, porosity, specific gravity and other characteristics. And our customer's laboratories often back us up with their own tests, giving high reports on Dicalite quality, Dicalite uniformity, and, all-important—Dicalite dependability.

Send for Bulletins—B-12, General Filtration; C-22, Use in Paint, Varnish & Polishes; F-52, Use in Paper & Pulp; F-552, Filtration of Potable Water; Filtration Manual for Dry Cleaning Plants.





## Cheapest Way to Give a Catalyst Nine Lives—or More!

Costly vacuum cleaning operation for a Western oil refinery was sucking hot catalyst from the regenerator of their fluid cracking unit. First flexible metal tubing, then steel pipe was used to conduct the extremely abrasive particles to the storage tank under 18" vacuum. But the tubing pulled apart in as little as two minutes. The pipe failed in only 48 hours.

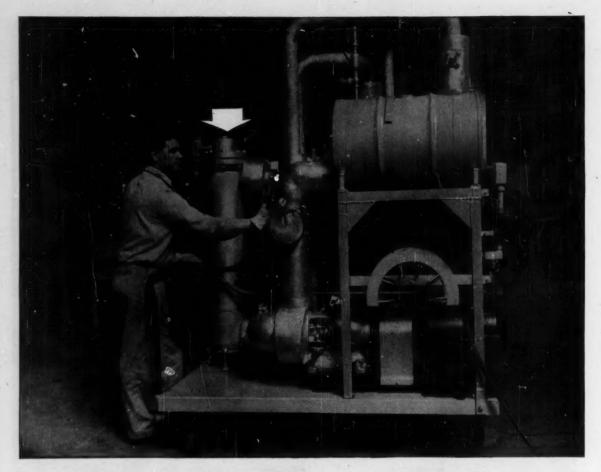
The G.T.M.—Goodyear Technical Man—recommended a special dry materials hose with a highly heat- and abrasion-resistant tube and full-faced, built-in flanges. At last report, this designed-to-the-job hose had served a total of 144 hours and looked good for much more.

Hose is a specialty of the G.T.M. He has over 800 types in actual production—hundreds more under development—all designed to lower your hose costs. You can benefit from his experience by contacting your Goodyear Distributor or Goodyear, Industrial Products Division, Akron 16, Ohio.

YOUR GOODYEAR DISTRIBUTOR can quickly supply you with Hose, Flat Belts, V-Belts, Packing or Rolls. Look for him in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods."

SPECIAL DRY MATERIALS HOSE by





## portable electrically heated unit provides high temperatures for heat transfer system

High temperatures were needed intermittently for reactors located in various spots throughout this chemical plant. But ordinary steam pressures were not sufficient to reach the higher temperatures. Stationary heating systems were inadequate. Safety considerations ruled out gas-fired systems. What to do presented a neat problem.

Installing an explosion-proof 15,000 watt Chromalox Electric Oil Circulation Heater in a portable plug-in heat transfer unit provided an equally neat solution.

With chlorinated biphenyl as the transfer medium, several pilot plant reactors are now supplied with heat as needed, up to 300°C. Thermostatic control regulates temperatures within plus or minus 2°C of selected setting. Water-cooled coil provides quick lowering of temperature when necessary.

Results are . . . desired capacity of 40,000 B.T.U.'s

per hour, accurately controlled, safely delivered at any designated time and place in the plant. Plus improved working conditions, long life and low cost of installation.

This problem-solution-result approach has enabled us to help many manufacturers produce better, faster, at lower cost.

Always available to you are our research, engineering, design and modern manufacturing facilities. The world's largest factory stock of industrial electric heaters plus local stocks at strategic points. And a 33-city nationwide sales-engineering service.

Let us know your problem for controlled heat and we'll go all out to help you find the right answerelectrically.

#### **EDWIN L. WIEGAND COMPANY**

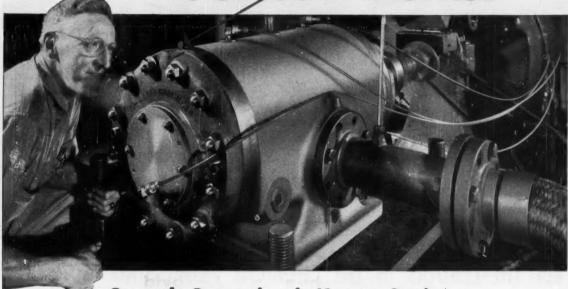
7514 Thomas Boulevard, Pittsburgh 8, Pa.



# Coin Trick Proves **RO-FLO** COMPRESSOR



Is Smooth Worker



**Smooth Operation is Key to Savings** 

Everybody around the place knew the Ro-Flo compressor was a smooth operator. But just how smooth?

Someone suggested the old coin trick . . . balance a coin on it while it's running.

The next we knew the foreman was calling, "Come down and see for yourself." We went to the shop. And sure enough, there the penny was standing as still as you please.

What does that mean to you?

It means, here's a compressor that needs practically no foundation. And it means there's no wear and tear from vibration...less maintenance.

You get constant air supply with this machine, too. For this story: Call your nearby A-C office for complete information, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

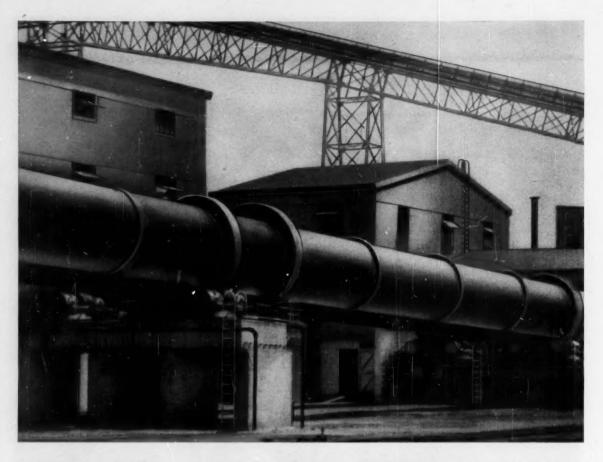
Ro-Flo is an Allis-Chalmers trademark.

# **ALLIS-CHALM**





Ro-Flo compressors provide constant efficiency and air supply for air tools



# LET THE LEADERS IN THE CHEMICAL PROCESSING INDUSTRIES HELP YOU SELECT A ROTARY KILN

Traylor Rotary Kilns are being used by leading producers the world over for calcining, roasting and chloridizing, volatilizing, sintering and nodulizing. Traylor Kilns have many exclusive features, developed as a result of actual field experience, which have earned them a universal reputation for extreme efficiency and rugged endurance.

Solid section steel riding rings of the full floating type are mounted on machined blocks to insure perfect fit. This special mounting holds them securely in place relative to the roller supports but permits them to float free of the shell as it contracts and expands. Traylor Kiln drives are completely mounted on a sole plate which is fully adjustable as a single unit . . . insuring perfect alignment and easy adjustment of main gear and pinion.

Traylor Rotary Kilns utilize secondary air to obtain maximum heat efficiency from every B.T.U. This Traylor feature achieves maximum thermo-processing economies. Another important feature is the individual consideration given to each installation. Every Traylor Kiln is especially made to fit the job it must do. Sizes have been made to 12'-0" diameter and 450'-0" long.

The universal acceptance of Traylor Rotary Kilns is best emphasized by the large number of customers who return time after time for additional Traylor Kilns. Before you buy your next kiln, do as so many of the world's leading producers have done . . . send for a copy of Bulletin 115 on Traylor Rotary Kilns.

### TRAYLOR ENGINEERING & MFG., CO.

841 MILL ST., ALLENTOWN, PA.

SALES OFFICES: New York • Chicago • San Francisco Canadian Mfr: Canadian Vickers, Ltd., Montreal, P.Q.





900









Primary Gyratory Crusher

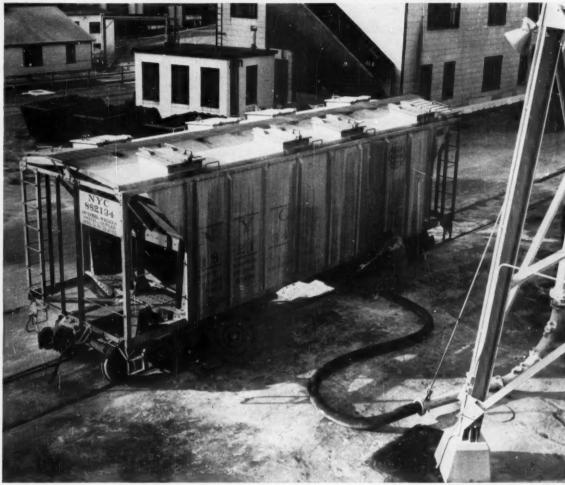
Rotary Kiln

Secondary Gyratory Crushers

Ball Mills

Jaw Crushers

# RESEARCH KEEPS B.F. Goodrich FIRST IN RUBBER



# No sore throat when rubber swallows quicklime

#### A typical example of B. F. Goodrich improvement in rubber

In making soft, smooth gelatin they use sharp, destructive quicklime by the carload. It was unloaded from railroad car to factory in the best flexible metal pipe but it wore and ate through the pipe in a few weeks. Much too expensive.

A B. F. Goodrich man heard about this cost problem and suggested a regular stock hose with a special tough rubber lining developed by B. F. Goodrich engineers for unloading other troublesome materials.

This B. F. Goodrich hose was tried

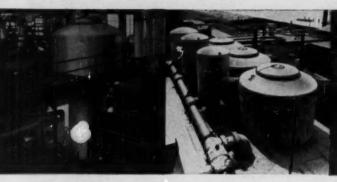
and has been handling a quarter million pounds of destructive quicklime a week ever since. It lasts five times as long as the more expensive metal, and is easier to handle from car to storage because it is so flexible.

This is one more of thousands of proofs of how B. F. Goodrich product improvement can save you money as it is saving so many other firms. The cost of anything, of course, is its price divided by the length of service it delivers. Buying for long service is the only businesslike way to buy

anything and that is why B. F. Goodrich products cost so much less. The assurance such quality gives you, the time you save in buying, handling and repairs, are extra B. F. Goodrich dividends you get when you call your B. F. Goodrich distributor for the latest improvements in all rubber products you use. The B. F. Goodrich Company, Dept. M-522 Akron 18, Ohio.

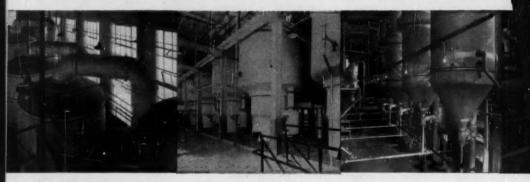
DIVISION





Long-tube, First-effect Pressure Evaporator operating on sugar juice, converting existing quadruple-effect to quintuple-effect. Swenson Multiple-body, Quintupleeffect, Long-tube, vertical evaporator in a kraft paper mill. A Swenson Spray Dryer used in a Distillery, handling distillers' solubles.

## **Every Spray Drying and Evaporating**



Swenson Forced Circulation Evaporators used for concentration of viscous, salting and scaling liquors.

Swenson Quintuple-effect Evaporator used in the processing of beet sugar. World's largest black fiquor evaporator installation—a multiple-effect with more than a half-million pounds of evaporation per hour.

## Engineering and Experience are called

#### Write Today for Information!

Get the complete Swenson Catalog . . . contains full information on long-tube vertical evaporator, spray dryers, crystallizers, forced circulation evaporators and recovery equipment for pulp mills such as pulp washers, black liquor evaporators, filters, and blow condensers.





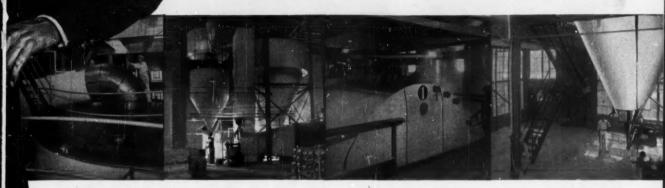
# . my problem is different!"

Sure, your problem is different! That's the way it is with evaporation and spray drying. Nobody knows that better than Swenson Engineers, for every day they are helping to solve problems for firms who process every conceivable type of chemical or food. For more than 60 years, Swenson has been the symbol of experience and research in new evaporating and

spray drying techniques. Swenson engineering has made possible lower production costs and the development of new products for new markets. The plant-scale research laboratories at Swenson are at your service to evaluate the potential of your product. Talk over your different problem with a Swenson engineer now —the collective experience that he has at his fingertips will help you answer it correctly!

#### SWENSON EVAPORATOR COMPANY

15669 Lathrop Avenue, Harvey, Illinois



A Swenson Spray Dryer in operation at a large whole milk drying plant.

A gas-heated Swenson Spray Dryer in operation at a chemical processing plant.

Swenson also engineers washers for the pulp industry . . . shown is a single-drum, two-stage washer.

A Swenson Spray Dryer installation used in the production of starch products.

## problem is different! That is why... Swenson



Swenson Multiple-effect, Long tube, Vertical Evaporator handling black liquor in a paper mill. Catchalls and cutout vapor piping for a large Swenson Long-tube, Vertical Evaporator installation.

Lower section of Spray Dryer Chamber in which distillers' dried solubles are produced. Swenson Multiple-effect, Quintupleeffect, Long-tube, Vertical Evaporator used for kraft mill black liquor.

upon by Industries everywhere. Remember ...

SWENSON

Proved Engineering for the Process Industries

Since 1889







# stainless steel holds the answers

Every industry that works with steel has its special problems of the proper steels for every job... more and more industries are finding that Stainless "holds the answers" to their problems.

Take the petroleum and chemical industries for instance. They demand resistance to corrosion, to abrasion, high temperatures, cold temperatures, scaling and hydrogen blistering. Solid stainless can do the job. But, in some equipment, stainless cladding can answer the problems . . . and cut costs as well.

Sun Ship knows how to fabricate stainless and the other special alloys. They have the facilities and experience. Large jobs or small jobs will receive prompt attention.

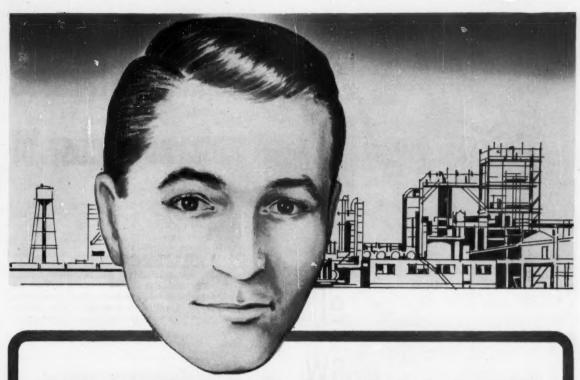
Our Sales Engineering Department will be glad to discuss with you any problems to which our Alloy Products Shop may hold the efficient and economical answer.



ALLOY PRODUCTS SHOP

OF SUM SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE . CHESTER, PA. . 25 BROADWAY, NEW YORK CITY



## ENGINEERS Join a Dynamic Company Now Entering Its 4th major expansion in its 4th year!

Rewarding challenges await alert engineers in this dynamic, rapidly-expanding new industrial frontier. These challenging advantages are now yours for the asking with an equally dynamic, expanding Company now in its fourth major expansion of its fourth year!

This company is The Chemstrand Corporation, already a leader in the field of synthetic fibers, with the world's largest integrated nylon producing plant.

The field of synthetic fibers is expected by

authorities to expand at least 1100 per cent by 1975. Chemstrand is growing with the industry itself and today ground-floor advantages to grow with Chemstrand are yours.

You would live in Decatur, Alabama, or Pensacola, Florida. Both cities offer ideal living conditions generally . . . exceptional schools . . . unsurpassed year-round sports and recreational facilities.

Wouldn't you like to get in on the "ground floor"



Immediate openings at Chemstrand's Nylon Plant at Pensacola, Florida, and Chemstrand's Acrilan\* Acrylic Fiber Plant, General Engineering Department, and Research & Development Center at Decatur, Alabama, for

ENGINEERS Chemical, Mechanical, Metallurgical,
Textile, industrial and Instrument

Wide range of research and engineering, including machine design, mechanical development, chemical process design and development, instrumentation, plant technical service and trouble-shooting.

Write for Interview, outlining your education and experience to — Technical Personnel Department ChE-2 THE CHEMSTRAND CORPORATION, DECATUR, ALABAMA.

TOMORROW'S BIG DECISIONS WILL BE MADE by the men who act today...



# Republic Stainless cuts cost of

Operator at left is removing scale accumulation from Clepco immersion heater casing made from Republic ELECTRUNITE® Stainless Steel Tubing. Any normal cleaning procedure may be followed without risk of damage to unit. And if your product demands cleanliness, the lustrous, smooth-finished surfaces of stainless tubing are clean, sanitary, and easy to keep that way. Solid stainless throughout, maintenance and replacement costs are reduced.

Operator at right is shaping  $2^p$  Republic ELECTRUNITE Stainless Steel Tubing to a bullet nose by spinning it under flame. Workability of this tubing makes it easy to fabricate. For heater casings, Cleveland Process uses both Types 304 and 316 Stainless Tubing which they find highly satisfactory for either acid or alkaline solutions—at temperatures ranging from  $100^\circ$  to  $600^\circ$ .

# REPUBLIC



World's Widest Range of Standard Steels

# **Tubing solves breakage problem...**

# Clepco immersion heater casings

The Cleveland Process Company of Cleveland, Ohio, manufacturers of Clepco immersion heaters, had a twofold problem. The tube-like casings they use to house heating elements were fabricated from a brittle imported material. Scale removal was particularly hazardous-often resulting in a cracked or broken casing. Furthermore, the material itself, although an effective insulation, was expensive.

To solve these problems, Cleveland Process switched to Republic ELECTRUNITE Stainless Steel Tubing for heater casings. They found ELECTRUNITE Stainless Tubing easy to fabricate, having consistently uniform diameter, wall thickness, concentricity, strength and ductility. But most important, ELECTRUNITE completely eliminated breakage and substantially reduced

Made of long-lasting Republic ENDURO Stainless Steel, this tubing provides strong resistance to corrosion, oxidation and scaling at high temperatures. Where strength is a requirement ELECTRUNITE Stainless Tubing is ideal-providing an extremely high strength-to-weight ratio.

This tubing may be the very material you need to improve your product or process. For detailed information about the many cost-saving advantages of Republic ELECTRUNITE Stainless Steel Tubing-including sizes, gages and analyses - send coupon today for new, illustrated 60-page booklet.



REPUBLIC ENDURO® STAINLESS PIPE SAVES COSTS in paper mills. Section shown above is part of a piping system that conveys the highly corrosive pulp mixture to the processing machines. Where corrosion-resistance is vital to cost savings, the extra expense of this longlasting piping is an inexpensive investment in long-range economy.



REPUBLIC SEMI-RIGID PLASTIC PIPE SAVES COSTS in cooling towers. Original pipe had to be replaced every four months in this cooling installation near coke ovens. A constant bath of corrosive steam saturated with hydrochloric acid soon destroyed it. Two years ago, Republic Semi-Rigid was installed with excellent results: no sign of damage to this date.



REPUBLIC DEKORON®-COATED EMT SAVES COSTS of electrical conduit in chemical plants. Wherever the atmosphere is corrosive, unprotected metal parts take a beating. But Dekoron-Coated EMT shrugs off corrosion. The tough, polyethylene coating over the galvanized finish gives double protection to electrical raceways. Send coupon for facts.

# STEEL

and Steel Products

#### REPUBLIC STEEL CORPORATION

3116 East 45th Street . Cleveland 27, Ohio

Please send me more information on:

- ☐ Republic ELECTRUNITE Stainless Steel Tubing
- ☐ Republic ENDURO Stainless Pipe
- ☐ Republic Plastic Pipe

Address\_

☐ Republic Dekoron-Coated EMT

Company\_\_

Zone\_State\_



**Closing Device** 

EASIEST to INSTALL and OPERATE....



Now — without re-boring . . . without altering parts . . . without removing so much as one plate — you can modernize your present filter press with one of the newest, most advanced of all labor-saving devices — the "HANDRAULIC" Closing Device by Sperry. (Or you can specify the "HANDRAULIC" as original equipment on new Sperry Filter Presses.)

On existing presses, simply remove one bolt . . . slip the "HANDRAULIC" in place . . . tighten the cap-screw . . . and that's it! Releases a powerful hydraulic surge for opening and closing the filter press . . . in seconds . . . without operator fatigue. And because the "HANDRAULIC" requires no extra support or foundation, it's practically portable. Replaces the filler block . . . takes up no extra space . . . and angles out of position to provide the maximum space for cleaning and maintenance.



#### SEND FOR FREE NEW BOOKLET

describing the "HANDRAULIC'S" simple erection and operating directions that can save you time, labor, material, and money. Also ask for Sperry's new, illustrated 42-page Filter Press Catalog. Both books are important . . . both are free. Send for your copies, today!

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Filtration Engineers for More than 60 Years

D. R. SPERRY & CO.



"ONE-BOLT" INSTALLATION!



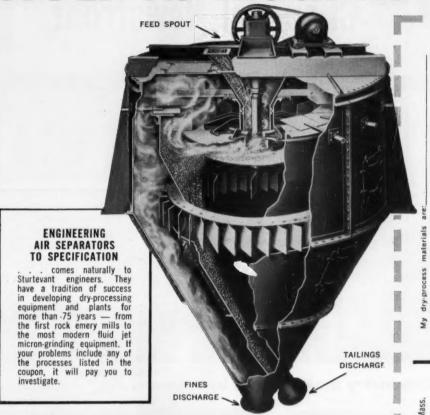
"ONE-MAN" OPERATION!



"ONE-MOTION"
CLEANING PROCEDURE!

Swing Handraulic to horizontal position, move slide head to open position, and filter press is ready for cleaning.

# 40 TO 400 MESH OUTPUT **UPPED AS MUCH AS 300%**



#### WHAT CAN A STURTEVANT AIR SEPARATOR DO IN YOUR PULVERIZING SYSTEM?

In the cement industry, Sturtevant Air Separators have a tested record of increasing mill capacities from 25 to 300% while lowering power consumption as much as 50% - when used in closed circuit with grinding mills. Maybe they can do as well for you.

Easily adaptable to your materials. Sizes of Sturtevant Air Separators range from 3 to 18 feet in diameter. They deliver fines from 40 to 400

mesh at rates as high as 100 tons per hour.

Designed to cut costs! Sturtevant Air Separators are built for a lifetime of low-downtime service. Rugged construction plus easy accessibility for quick maintenance (typified by the "OPEN-DOOR" design in other Sturtevant equipment) assures more output per machine-year. Check the coupon for more information.

# **TURTEVA**

Dry Processing Equipment

The "OPEN-DOOR" to lower operating costs over more years

CRUSHERS . GRINDERS . MICRON-GRINDERS . SEPARATORS BLENDERS . GRANULATORS . CONVEYORS . ELEVATORS

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Also bulletins send

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BLENDING

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# Life ... on the ... on the Newsfront



POLYACRYLONITRILE, ANOTHER NEW CHEMICAL, offers some interesting properties you may find worth-while evaluating. It is a white, free-flowing powder of extremely fine and uniform particle size, with a molecular weight of 130,000. Relatively heat stable, it is hard and is a good insulator. Polyacrylonitrile is insoluble in most solvents except highly active ones such as dimethylormamide, 8-butyrolactone, and ethylene carbonate. Although considered inert, polyacrylonitrile may be altered by modification of the nitrile groups through such reactions as hydrolysis or hydrogenation. If you see possibilities in polyacrylonitrile, let us send you a sample. (New Product Development Deportment, Section B)

### **Chemistry makes news in Cosmetics**



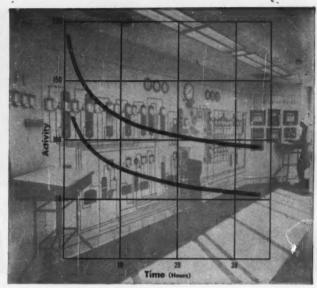
NEW SHAMPOO FORMULATIONS that clean without depleting the scalp and hair of their natural oils can be compounded with Cyanamid's new Aerosol.® 22 Surface Active Agent. Detergency tests of Aerosol. 22 on wool show high removal of soil and low removal of oil. Additions of up to 20% of Aerosol. 22 to liquid detergents, such as triethanolamine lauryl sulfate and nonyl phenolethylene oxide condensates, reduce their drying or defatting action on the skin. A new bulletin on Aerosol. 22, containing suggested formulations and describing other applications, will be sent on request. (Industrial Chemicols Division, Dept. B)



THE FIRST PLASTIC AEROSOL DISPENSER is making news in the toiletries industry. Developed by Colt's Manufacturing Company, Hartford, Conn., in collaboration with Cyanamid, it is molded of Melamine Molding Compound 1077. Melamine allows precision molding to close tolerances with the necessary stability to hold its dimensions under pressure. The spray package is rigid, break resistant, corrosion resistant, light, convenient to fill and ship. It offers unusual design possibilities in any color. Only nonplastic component is a stainless steel spring activating the collet, (Plastics and Resins Division)



FEEDING OF AUREOMYCIN® Chlortetracycline to lambs and beef cattle from start to market helps prevent disease, produces healthier animals and promotes faster weight gains. Five years of extensive research at experimental stations shows that Aureomycin Chlortetracycline lowers the incidence of disease, as well as mortality and morbidity. Two new Auriofac® feed supplements, containing 1.8 milligrams of Aureomycin Chlortetracycline, are being introduced through feed manufacturers to improve feeding programs. (Fine Chemicols Division)

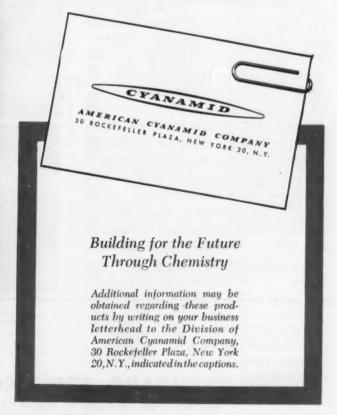


THIRTY-FIVE HOURS IN THE LIFE of two gasoline refining catalysts, tested at 1500° F under 1 atmosphere of steam, are charted above. The graph shows the greater thermal and steam stability of Cyanamid's new Hi PV° Catalysts (upper curve) over a catalyst in current use (lower curve). By increasing pore volume, in careful balance with pore diameter and specific surface, Cyanamid has given Aerocat® Fluid Cracking Catalysts activity that stays high longer under conditions of refinery operation. Activity maintenance means high efficiency in gasoline production. Extensive experience with Hi PV Catalyst in refining units has demonstrated commercially these performance characteristics. (Industrial Chemicals Division, Dept. B)

\*Trade-mark



GOOD PLASTICITY IS ACHIEVED in natural rubber with Pepton® 65 Plasticizer, which permits mastication at low temperature. This newest addition to Cyanamid's extensive line of rubber chemicals allows a reduction of as much as 30% in the milling cycle while still imparting the desired plasticity. And where the milling cycle is held constant, the viscosity of the rubber is substantially reduced—an important performance feature in processing soft rubber for products such as blown sponge. (Organic Chemicals Division)





A 20' long, 11'6" wide nodulizer section of a 10' x 150' Rotary Kiln ready for shipment from the Standard plant.

# RUGGEDNESS

Western Style

# STANDAR D

The illustrations shown here give added proof of the time-tested slogan—"It Pays to STANDARD-IZE". Here is just another example of Standard's ability to produce rugged rotary equipment for any job, large or small.

From all over the country—North, East, South, West — whenever the need is for dependability—the call is for Standard. See for yourself why the list of satisfied Standard users grows every day.

With over 50 years of precision engineering behind it, Standard is ready to help solve your problems—here or abroad. Write today for the complete Standard Story.

# KILNS—CALCINERS COOLERS—DRYERS



A small section of the kiln, installed and in use at a large western manganese company.

A close-up view of the same kiln. Note the solid construction. Standard Kilns are built to last.

SEND FOR FREE 12-PAGE ILLUSTRATED BULLETIN
Learn how STANDARD-HERSEY
has aided manufacturers throughout the
world in solving their dryer problems.



COMPLETE PILOT PLANT TAKES
GUESSWORK OUT OF DRYING
STANDARD-HERSEY'S pilot dryers
play an important part in solving your
drying problems before blueprint stage.

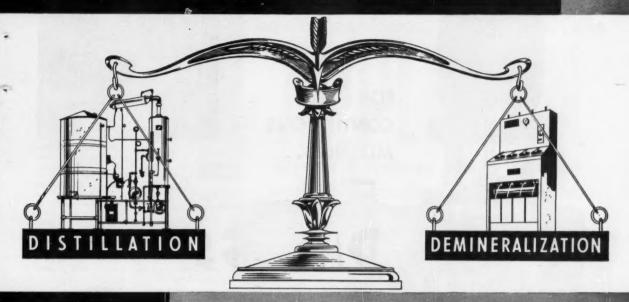


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STANDARD STEEL CORPORATION

5005 Boyle Avenue, Los Angeles 58, California • 15 Park Row, New York 5, N. Y.

# WHAT will solve your Pure Water Problem?



## Rarnstead can give you an IMPARTIAL answer!

STILLS AND DEMINERALIZERS do two different jobs . . . produce two different kinds of Pure Water! The difference is this: Stills remove all impurities: ionizable and non-ionizable, including silica, organic matter, and bacteria; Demineralizers remove only ionizable impurities. The cost of operation however is generally lower than distillation with a water still.

Whether your Pure Water problem calls for a Still . . . a Demineralizer . . . or both, Barnstead can give you the right answer - the IMPARTIAL answer! For Barnstead makes both Stills and Demineralizers of every type ... of every size.

Since 1878, Barnstead Water Engineers have helped industry solve more than 75,000 tough purity problems all over the world. This pioneering experience is at your service. For a consultation with a Barnstead Engineer — and a prompt, effective, permanent solution to your problem - fill out and mail the coupon now. There is, of course, no cost or obligation.



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Illustrated above Type SS Model Steam-Heated Still. Barnstead Stills produce pure water of unvarying qual-ity from 50 to 1000 gallons per hour for gallons per hour for industrial use.



In 3 years of operation, this 500 gallon per hour Barnstead Mixed-Bed Demineralizer has produced over 4 million gallons of high-purity demineralized water with a minimum of maintenance or attention.

Gentlemen:	We	ask	your	help	and	advice	on	the
following p	ure w	ater	proble	m:	******	100000000000000		*******

. Position.

Street & No. ...

First in Pure Water Since 1878



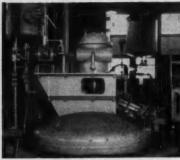
FOR CONTINUOUS MIXING . . .



Use Nettco Flomix to combine liquids, gases and liquids, and liquids and solids as they flow through a pipe line. Flomix gives you these important advantages: • fast, uninterrupted processing, • increased uniformity of product, • simplified piping layouts, • complete elimination of intermediate storage tanks and mixing vessels, and • reduced maintenance.

Nettco Agitation Engineers are ready to discuss the application of Nettco Flomix to your continuous processing problems: for mixing, blending, reacting, washing, contacting, bleaching, absorbing, chlorinating, clarifying. Send specifications for engineered recommendations to New England Tank & Tower Co., 87 Tileston Street, Everett 49, Massachusetts.

ETTCO NEERED AGITATION





Nettco Model WT Agitator in modern processing plant — an engineered combination of Nettco's standardized units assembled to handle the special mixing requirements of this leading dyestuffs manufacturer. The complete line of Nettco tank top, side entering, and pipe

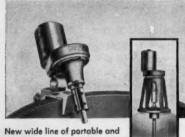
line mixers, and Nettco agitator accessories is described in our Bulletin 551. Write for your copy today.





Nettco Model KBA Side Drive Agitator with V-belt drive. Standard Nettco side drive units are available in the full range of horsepowers from 1/3 to 30 . . . and in special alloys to meet specific process conditions. Tailored to your requirements with mechanical seal, with

or without shut-off... or stuffing box with or without shut-off. For detailed information, ask for Bulletin No. 532.



New wide line of portable and tripod mixers in capacities from 1/6 to 2 HP . . . in high speed (1800 RPM) or medium speed (420 RPM) ranges. Feature high efficiency — leak-proof housings — adaptability to sanitary installations. Open, totally enclosed, and explosion-proof motors available . . . ii speeds. Request complete data.

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UNIQUE

VERSATILE

another Nepatented (No. 2183859)

— has mixed from clay slip

— installations of 400 GPM a ities of 75,000

- to 400 psi.

pressures poss

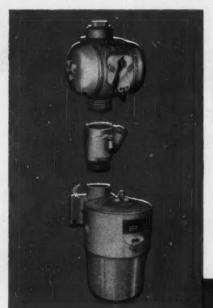
- to 300° C.

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**PRESSURES** 

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For complete protection . . . against explosion, dust, rain . . . use

# APPLETON

Circuit Breaker, Motor Starter and Combination Motor Starter

UNILETS

#### **More TOP-QUALITY features!**

- First to be U.L. Approved for banked circuit breaker grouping
- Combinations meet U.L. requirements through approval of components
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- Units may be added quickly, easily
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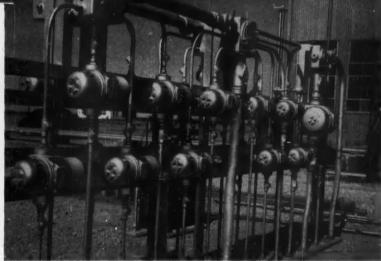


Photo courtesy Oil & Gas Journal

A typical bank of APPLETON Circuit Breaker Unilets in a main line booster station

Also Manufacturers of:



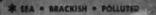
The biggest advancement in Explosion-Proof design in years! The design, construction and performance of APPLETON Circuit Breaker and Motor Starter Unilets give you maximum safety and unparalleled ease of wiring, installation and maintenance. You'll discover initial and long term savings plus many exclusive APPLETON features, not found in any other enclosure. Where absolute safety is required, regardless of the installation, APPLETON can serve you better! Send for Bulletin BH today for complete information!

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Rely on APPLETON . . . the Standard for Better Wiring

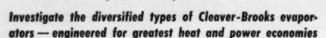


# How to make any water <u>pure</u>

FOR DRINKING PROCESSING

• DRILLING MUD MAKE-UP





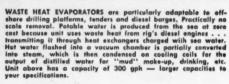
The broadened line of Cleaver-Brooks evaporation equipment now includes types for a wide variety of operating conditions—and to answer *any* need for pure potable water or high quality process water.

- Sea water, brackish water or polluted streams may be used as a prime source, thus eliminating independent pipe lines, trucking or barging.
- prime source, thus eliminating independent pipe lines, trucking or barging.
   Distillate is uniform in quality regardless of raw water source.
- Evaporators are completely packaged, delivered insulated and fully assembled, ready to receive supply and discharge lines.
- Stationary or mobile units operate independently and automatically after initial starting.

Cleaver-Brooks is highly qualified to design and fabricate evaporators (including special heat exchangers) to your specifications. For complete details, write: Cleaver-Brooks Company, Special Products Division, Dept. A, 364 E. Keefe Ave., Milwaukee 12, Wis., U.S.A, Cable Address: CLEBRO—Milwaukee—all codes.



BUILDERS OF EQUIPMENT FOR THE GENERATION
AND UTILIZATION OF HEAT AND POWER



FLASH-TYPE EVAPORATOR—Combination of four (4) 50,000 gallons-per-day evaporators with a total distilled water capacity of 200,000 gallons per day. Unit will provide entire water supply for super carrier of the U.S.S. Forrestal class. Low-pressure steam is bled from propulsion turbines.

VAPOR COMPRESSION EVAPORATOR (Model 3300 DO) — Provides pure water at approximately one-half the cost of other methods. Specially suited for tankers and other bulk-cargo vessels. Distilled water capacity—300 gallons per hour.

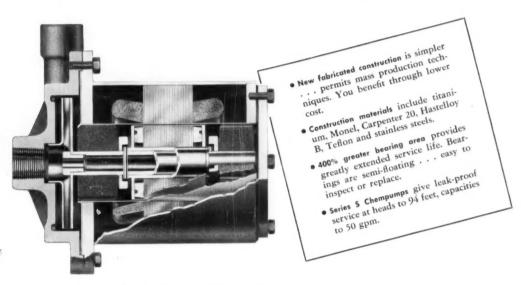
TRIPLE-EFFECT EVAPORATOR (Model F200 TE) — Exceptional economy where sufficient quantities of inexpensive lowpressure steam is readily available. Will produce 200 gallons per hour from softened city water supply.







# NEW DESIGN FEATURES OF LEAKPROOF "CANNED" PUMP extend applications... SLASH PRICE 20-25%!



Fifteen years of design and operating experience are built into this new low-cost sealless Chempump.

You will benefit directly. You get the cost-saving advantages of mass production techniques. You get a choice of materials of construction that can handle practically any known corrosive. You get a "canned" pump that can't possibly leak, that requires no lubrication, that virtually eliminates maintenance. Oversized, semi-floating bearings give thousands of hours of service under difficult conditions . . . cut-outs provide fool-proof motor winding protection for both overcurrent and excessive heat.

The new Series S Chempumps will be available shortly in ½3 and ¾4 horsepower sizes, with larger units coming. The price is competitive with a quality centrifugal equipped with a mechanical seal. Talk with the Chempump engineering representative in your area about saving through quantity purchases.

For complete details, write for Bulletin 1030
 CHEMPUMP CORPORATION
 1300 E. Mermaid Lane, Philadelphia 18, Pa.

Chempump

First in the field . . . process proved

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Carbon Steels

Carbon-Molybdenum Steels

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**Nickel Steels** 

Chromium-Nickel Steels

Chromium-Silicon-Molybdenum

Wrought Iron

**Chromium Type Stainless** 

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Molybdenum Type Stainless

Wrought Aluminum

**Aluminum-Copper Alloys** 



1/2 inch through 42 inches . . .



FORGED CORROSION RESISTANT—LIGHT WEIGHT and A.S.A. FLANGES

1/2 inch through 24 inches . . .



FORGED SCREWED OR SOCKET WELDING FITTINGS and UNIONS

1/8 inch through 4 inches...



LARGE DIAMETER AND T.E.M.A.\* STANDARD FLANGES up to 20 feet O.D.

\*Tubular Exchanger Manufacturers Association

LONG WELDING NECKS up to 24 inches, 150 lb. through 2500 lb.

# Complete Service.



**BUTT WELDING FITTINGS** 

Schedules 55, 105, 405, 805, and other Schedules and wall thickness.



FORGED CORROSION RESISTANT—LIGHT WEIGHT and A.S.A. FLANGES 150 lb. through 2500 lb. pressure ratings.



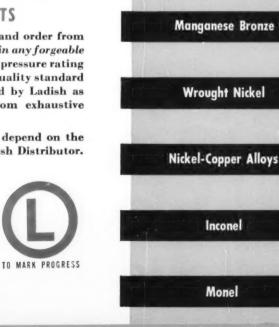
FORGED SCREWED OR SOCKET WELDING FITTINGS and UNIONS 150 lb. Corrosion Resistant and 2000 lb. through 6000 lb. ratings.

#### FOR FITTINGS FROM ANY FORGEABLE MATERIAL TO MEET YOUR SERVICE REQUIREMENTS

You get prompt, efficient service when you specify and order from the complete Ladish Controlled Quality line. Fittings in any forgeable material in virtually every type, size, wall thickness or pressure rating ... are produced to one uncompromising Controlled Quality standard ... and identified with heat code symbols pioneered by Ladish as verification of metallurgical integrity resulting from exhaustive tests made in the Ladish metallurgical laboratories.

For complete service on your fittings requirements, depend on the Ladish line and the services of your Authorized Ladish Distributor.

THE COMPLETE Controlled Quality FITTINGS LINE CUDAHY, WISCONSIN District Offices. New York & Buffalo & Pittsburgh & Philadelph



Aluminum-Manganese Alloys

**Deoxidized Copper** 

Hastelloy

**Titanium** 

Forging Brass

**Everdur Bronze** 

Silicon Bronze



# TITANIUM

#### SOLVES TOUGH CORROSION PROBLEMS

HOT NITRIC ACID at pressures of 300 psi took a high toll of stainless-steel condenser tubes at a Du Pont plant—until this titanium "top-hat" was installed. Fabricated entirely of titanium, it provides a protective sleeve inside the top 3 inches of the condenser tubes. The unretouched photo shows the clean, uncorroded appearance of the "top-hat" after 14 months' continuous service. The titanium tube sheet, tubes and welds have essentially the same appearance as when installed . . . show evidence of being able to serve indefinitely.

HIGH-VELOCITY STEAM and biting hydrochloric acid were cutting the service life of cast-iron steam diffusers to less than 3 months at a Du Pont Pigments plant. Bronze and corrosion-resistant alloys were tried, without improvement. Then a diffuser fabricated from titanium was installed. This proved to be the answer. The photo shows the condition of the titanium diffuser after 2 years' service—a period ten times the average life of other diffusers. Compare the uncorroded appearance of the titanium diffuser with the cast-iron flange, which shows severe acid attack.



#### A partial list of other environments where TITANIUM offers unmatched corrosion resistance...

#### CORROSIVE CHEMICALS

Ferric Chloride Sodium Chloride

Chlorine-Saturated Water

Wet Chlorine Gas

Chromic Acid

Sulphuric-Nitric Acid Mixture

Calcium Hypochlorite
Zinc Chloride

#### CONDITIONS

0-30% at 100° C. All Conc. at 100° C.

Room Temperature

75° C.

10% and boiling

40% sulphuric, 60%

nitric at 35° C.

6%-35° G. 20%-100° C.

#### POSSIBLE APPLICATIONS

Process piping Kettles, heat exchangers

Proportioning equipment Recovery equipment, electrolytic cells

Plating equipment

Acid heaters, nitrators, auxiliaries

Filter presses, processing equipment Coils, pans, evaporators

#### TITANIUM MAY BE THE ANSWER TO YOUR CORROSION PROBLEM

If you're looking for a way to improve your product . . . or cut production and maintenance costs by extending the service life of essential equipment . . . it may pay you to investigate titanium. As a pioneer supplier of titanium sponge, Du Pont has the experience to offer you expert technical help with your evaluation tests . . . can put you in touch with manufacturers best equipped to work with you on your particular product or application. Con-

siderable fabricating know-how and a wide variety of mill shapes are available now to help you use titanium to solve your corrosion problems. For more detailed in-

formation on titanium, just check the coupon below, or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Wilmington 98, Delaware.



### TITANIUM SPONGE

PIONEERED COMMERCIALLY BY DU PONT



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.) Pigments Department CE-1

Wilmington 98, Delaware

- Please send me your new technical bulletin on the corrosionresistant properties of titanium.
- Please send me your general booklet on titanium.

I am interested in using titanium for:\_\_\_\_\_

Name

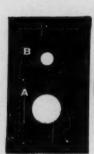
Address\_

City\_\_

State

Position\_

#### TALK ABOUT



Discharge orifice of 1° NICHOLSON trap (A) compared with other types of same size (B). Nicholson's greater—in every size!



Compare capacity of a Nicholson Steam Trap with any other trap of same size. Greater capacity—right across the board—means Nicholson Industrial Traps discharge condensate and air from steam lines and process equipment faster, more effectively. In toughest chemical processing service, Nicholson's pay off 4 ways:

- lower initial cost-more for the money
- less upkeep expense-minor maintenance
- faster warmup—high, even temperatures
- faster production—increased 20% to 30%

Where performance counts, specify Nicholson. Write for Catalog 953.



# W.H. NICHOLSON and Company TRAPS . VALVES . FLOATS . METAL PARTITIONS

14 DREGON STREET, WILKES-BARRE, PA. - SALES AND ENGINEERING OFFICES IN 58 PRINCIPAL CITIES

You get more than a mixer at

#### SPROUT-WALDRON

You also get reliable guidance on installations and applications from our engineering representatives. They are in a position to recommend, without bias, the exact mixer to do your job best

That's because Sprout-Waldron offers complete lines of all types of mixers-verticals. horizontals, continuous, and blenders.

Sprout-Waldron representatives are thoroughly experienced in solving mixing prob-lems for the processing industries.

A typical sales engi- BRUCE BROWN neer is Bruce Brown,

pictured here, who came with Sprout-Waldron directly from Stevens Institute. After 2 years at the home office in the engineering, experimental and cost departments, Bruce became a Sprout-Waldron representative. His ability to analyze difficult processing problems and suggest solutions has made him val-

uable to the customérs he serves.
With such men to help you, you are assured of economical, efficient equipment and service from Sprout-Waldron.



BATCH MIXERS



For the rapid, intimate mixing of small percentages of a number of critical ingredients with large percentages of basic material, a Sprout-Waldron Style "B" Horizontal Batch Mixer can cut costs and improve quality of end products.

#### SPROUT-WALDRON CONTINUOUS MIXERS

These large, doubleagitator mixers are ideal for adding hot or cold liquids,

viscous or otherwise, to dry materials on a continuous basis.

#### SPROUT-WALDRON MATERIALS HANDLING EQUIPMENT

To get materials to and from mixers, Sprout-Waldron offers complete lines of screw and belt conveyors, bucket elevators, feeders, and the revolutionary Pneu-Vac air handling system.



# any MIXER YOU NEED



in size and quality...

Here are, we believe, the world's largest and the world's smallest vertical mixers-both Sprout-Waldrons. The giant at the right has a capacity of 1500 cu. ft. The capacity of the pygmy on the left is 10 cu. ft.

SPROUT-WALDRON

# ERTICAL MIXERS

You'll find at Sprout-Waldron the greatest variety of vertical mixers -ranging from the world's largest to the world's smallest-with the most advanced features. They're money-saving answers to the problems of mixing dry, free-flowing materials of a uniform particle size because.

Sprout-Waldron verticals permit the mixing of a limited amount of liquids with dry ingredients. They occupy little floor space and have low horsepower requirements. One with a capacity of 1500 cu. ft. takes up only 80 sq. ft. of floor space and operates on as little as 30 h.p. These mixers are completely self-cleaning and can be made dust-tight and pressure-tight. Loading or charging is fast from either the top or from the operating floor level. Available in wood, stainless steel, carbon steel, and non-ferrous or commercial alloys. Large models are ideal as mixing reservoirs or holding bins to maintain absolute uniformity of mixes that are produced from several production lines.

All equipment can be adapted to meet your special needs through Sprout-Waldron's unique "adaptioneering" methods. Let us advise you on your next mixer installation. Write for details.

#### PROUT-WALDRON

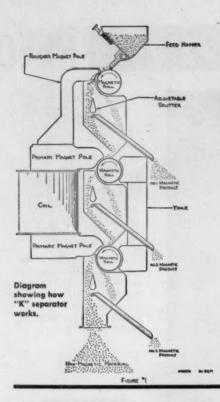
Manufacturing Engineers Since 1866

LOGAN STREET . MUNCY, PA.

Equipment for SIZE REDUCTION, MIXING & BLENDING, PELLETING & CUBING, BULK MATERIALS HANDLING, PRODUCT CLASSIFICATION

Facilities for fabricating, machining, custom founding, woodworking, laboratory testing

PR/406,



#### FEATURES THAT PUT THE "K" OUT FRONT:

#### Magnetic field protected against flux leakage

Magnet support frame is not part of magnetic circuit. Specially constructed steel rolls with non-magnetic stub shafts further insulate magnetic circuit.

#### 2. Simple adjustment

Positive, easy control of feed rate, air gap width, splitter settings for extremely accurate separation. So simple, unskilled workers can operate and adjust it.

#### 3. Uniform material distribution

Louver-type feeder provides uniform distribution across entire feeder width. Speed of feed closely matches roller speed for greatest efficiency.

#### 4. Powerful magnetic force

Primary pole noses are scientifically shaped to give maximum flux density in separating zone—take full advantage of powerful electro-magnetic force.

#### 5. Dependable, long-lasting

Triple-sealed bearings keep out dust, insure smooth, low-cost operation. All parts are easily accessible for service.

#### Here are some products the "K" handled profitably:

Silica Sand Feldspar
Scheelite Nepheline
Soda Ash Dolomite
Silicon Carbide Bauxite
Aluminum Oxide Magnesite
Fire Clay Sodium St
Kyanite Fluorspar
Phoephate & Derivatives Sodium S

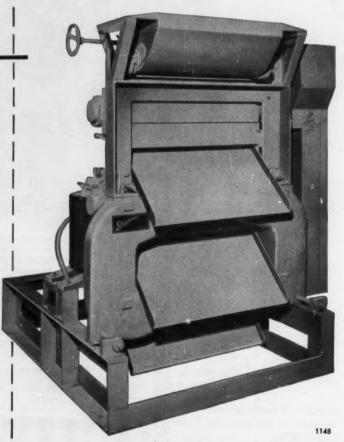
Feldspar Nepheline Syenite Dolomite Bauxite Magnesite Sodium Sulphate Fluorspar Sodium Sesquicarbonate Sodium Carbonate

### Purifies and concentrates Bulk Chemicals where other methods fail

STEARNS HIGH-INTENSITY MAGNETIC SEPARATOR

Stearns Type K magnetic separator provides an intensely powerful magnetic field which attracts very feebly magnetic particles. That is why the "K" has proved highly successful in purifying and concentrating chemical products when other methods were either impractical or inadequate.

Users report that this separator has given outstanding results for magnetically cleaning or concentrating materials ranging in size from 10 to 200 mesh. Capacity ranges from 80 to over 500 lb per hr per inch of feed width. "K" separators are built in 10, 20 and 30-in. feed widths and can be furnished with from 2 to 7 magnetic fields. Complete laboratory facilities available for testing samples of your product. We invite comparison of results. Write today for bulletin 701B.



MAGNETIC EQUIPMENT FOR ALL INDUSTRY





STEARNS MAGNETIC, INC., 629 S. 28th St., Milwaukee 46, Wis.

# Lapp introduces the "MICROFLO" PULSAFEEDER

A CONTROLLED-VOLUME PUMP FOR PRECISION PUMPING AT MICRO-FLOW RATES

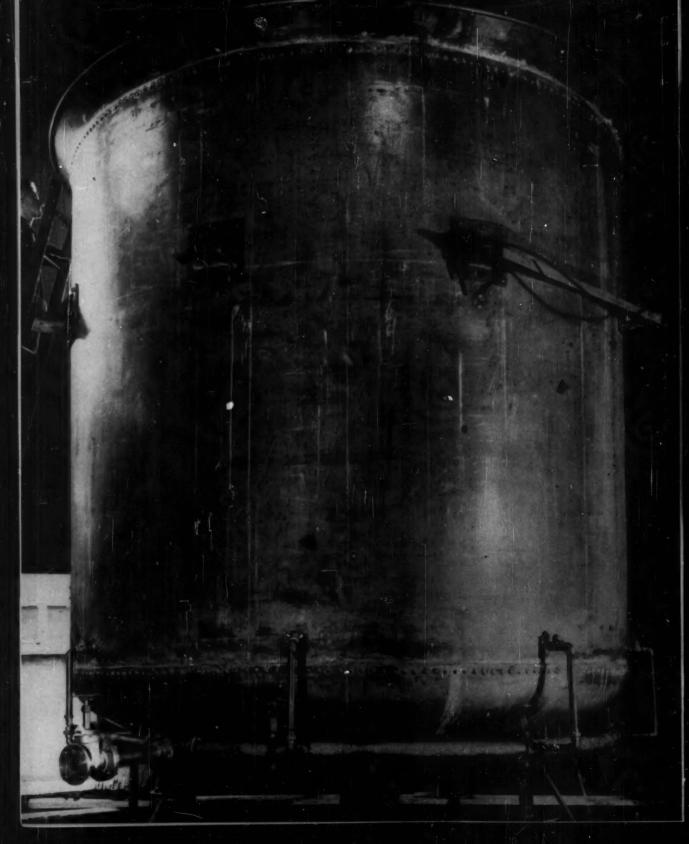


Now, a controlled-volume proportioning pump for laboratory application, pilot plants, and industrial production, where requirements are for pumping of precise volumes at micro-flow rates without risk of leakage or contamination of fluid being pumped. The "Microflo" Pulsafeeder combines the best features of both piston and diaphragm pumps by using a piston for constant volume measuring purposes and a diaphragm to seal the product pumped against leakage or contamination. All liquid handling parts have been selected for their resistance to corrosion. Maximum pumping capacity is 2150 ML. per hour, maximum discharge pressure 1000 psig. Pumping rate of the "Microflo" Pulsafeeder can be manually adjusted while the pump is idle or operating, or if desired, complete operation can be governed by automatic controls.



#### WRITE

for Bulletin 500 which contains complete information and specifications on the new "Microflo" Pulsafeeder. Lapp Insulator Co., Inc., Process Equipment Division, 474 Wilson St., LeRoy, N. Y. BRIGHTON



# BUILDS THE BIG ONES!

This Vessel is a heavy copper still kettle, riveted and silver brazed—used for chemical distillation. Building huge kettles like this is an important part of our business at Brighton.

We work metal—stainless steel, copper, bronze, aluminum, nickel, monel metal and other alloys. More important, our craftsmen make metal work for you! They build with precision to your specification, select highest quality tested metals, finish your job with a thoroughness that only true craftsmen can provide. Heart and pride are in their work.

We have facilities and skilled metalsmiths to build chemical process equipment of virtually any size — pilot model to full scale. Typical work — fractionating columns, heat exchangers, pressure vessels (jacketed or unjacketed), agitating equipment, tanks, coils, evaporators. We will be happy to submit a prompt estimate on your fabrication job. Write today for full information.



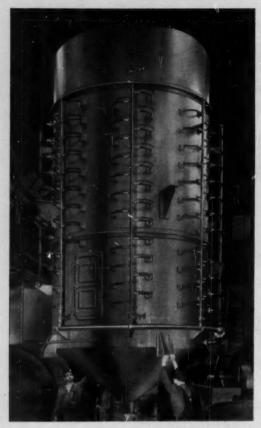
# Have Brighton Bid Your Big Ones!

BRIGHTON COPPER WORKS, INC.

822 State Avenue, Cincinnati 4, Ohio

**Process Equipment for the Chemical Industries Since 1914** 

### AIR CLEANING IN METALLURGICAL PROCESSES



#### HARMFUL OXIDES OF LEAD AND ACIDS REMOVED

Buffalo

PROBLEM: The burning of old lead and melting of lead ingots in a reverberatory furnace resulted in a hot effluent gas containing harmful oxides and acid contaminants. The corrosive nature of the effluent prevented solution of this nuisance and health hazard by ordinary air cleaning equipment.

SOLUTION: A "Buffalo" Hydraulic Scrubbing Tower was selected. This unit utilizes pre-cooling sprays at low pressure (waste water) and high pressure fog sprays (400 psi at nozzles). This Tower is of corrosion resistant materials, lead-lined inside, with phenolic coated nozzles. It cleans by spray scrubbing action and gravity travel of materials trapped in fog layers.

RESULT: The effluent gases were rendered nuisance-free from the start, and operation has been trouble-free. Even after more than 3 years, no replacements of linings or nozzles have been made or required. Other advantages have been very low resistance to gas flow, small floor space requirements, stable performance and easy access to all operating parts for maintenance without interruption to production.

### PUT "BUFFALO" EXPERIENCE AND FACILITIES TO WORK ON YOUR AIR CLEANING PROBLEM

This is one of hundreds of records in our files on the successful solution of air cleaning problems in every industry. This experience, plus "Buffalo" air cleaning units and factory facilities, are ready to help you. Just call on the "Buffalo" engineer in your nearest prin-



cipal city.

VENTILATING • HEATING • AIR CLEANING

AIR TEMPERING • INDUCED DRAFT • EXHAUSTING

COOLING • FORCED DRAFT • PRESSURE BLOWING



#### FAMOUS LIGHTHOUSES OF AMERICA



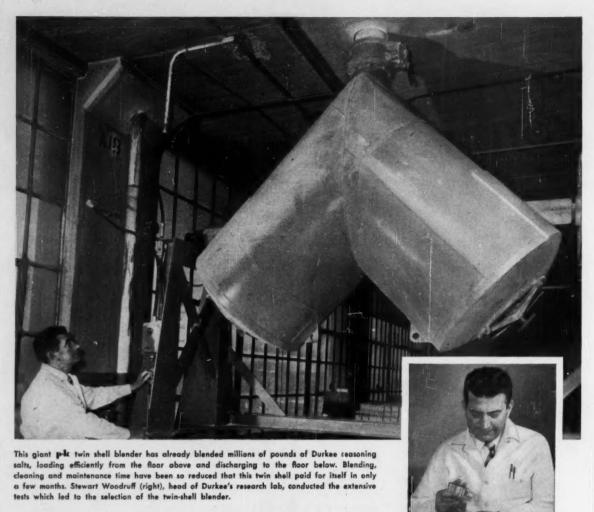
BARNEGAT LICHT is located on Island Beach at the south side of the entrance to Barnegat Inlet, New Jersey. For more than a century its beacon has been a familiar course-marker to all craft traveling the steamer lanes off the Jersey coast. The first lighthouse, built in 1835, was leveled by a pounding Atlantic, The present tower, 161 feet high and made of brick, was completed in 1858, 900 feet south of the original structure. The tower itself is now owned by the State of New Jersey but the light is maintained by the U. S. Coast Guard.

**Lighting Ways to Progress** and steady growth in the field of electrochemicals is the Niagara Alkali Company—a pioneer in the development, production and use of these important products. Rely on Niagara for uniformly high quality in Nialk® Liquid Chlorine, Nialk Caustic Potash, Nialk Carbonate of Potash, Nialk Paradichlorobenzene, Nialk Caustic Soda, Nialk TRICHLORethylene, Niagathal® (Tetrachloro Phthalic Anhydride).

#### NIAGARA ALKALI COMPANY

60 East 42nd Street

New York 17, N.Y.



"Blends perfectly; virtually self-cleaning":

#### DURKEE SELECTS p-Ic BLENDER AFTER LABORATORY "PRE-TEST"

We're at Durkee Famous Foods, in Elmhurst, N. Y.... and you're looking at a 1000-lb. p-k twin shell blender which was so thoroughly pre-tested, success was assured even before it was installed!

Extra-effective blending is a must at Durkee, because physical segregation between various ingredients in Durkee's onion salt and garlic salt is a problem. That's why, when it comes to choosing a blender, there could be no guesswork.

The twin shell, along with other blenders, was put under careful scrutiny. A 4-quart p-k laboratory model underwent a series of tests in Durkee research labs.

There, in much less than half the time needed to produce a hand sample of almost perfect theoretical value, the p-k twin shell, in test after test, produced identical samples. Because blending results obtained with twin shell lab models scale up accurately to production sizes, Durkee research men knew the twin shell was the "just right" blender for the job-before it was purchased!

To find out how you, too, can "pre-test" a p-k twin shell blender in your plant, lab or mill, write us today. Ask, too, for your copy of p-k Catalog 13. It is free for the asking, of course. The Patterson-Kelley Co., Inc., 110 Lackawanna Avenue, East Stroudsburg, Penna.

# PATTERSON P KELLEY

€ 250

Offices: 101 Park Avenue, New York 17 \* Railway Exchange Building, Chicage 4 \* 1700 Walnut Street, Philadelphia 3 \* 96-A Huntington Avenue, Boston 16 and other principal cities

## How to pick the 1 tubing steel out of 24 to give you longest tube life per dollar

Ask the experts!

F THE 24 different high-temperature tube steels Of the Timken Company offers to solve your heat, pressure, corrosion and oxidation problems, one analysis is most exactly suited to your particular needs, to give you maximum tube life per dollar of cost.

To find this analysis, ask the experts.

These experts are the metallurgists of The Timken Roller Bearing Company. The benefit of their more than 20 years of steel research and experience—with emphasis on high-temperature steels—is yours for the asking. They'll help you select the analysis that will give you longest tube life for your money—the only true measure of actual tube steel cost.

Whichever analysis you choose, you can be confident of uniform quality. The Timken Company maintains rigid quality control from melt shop through

Why not let the Timken Company's metallurgists help pick the tubing steel that can solve your problem?

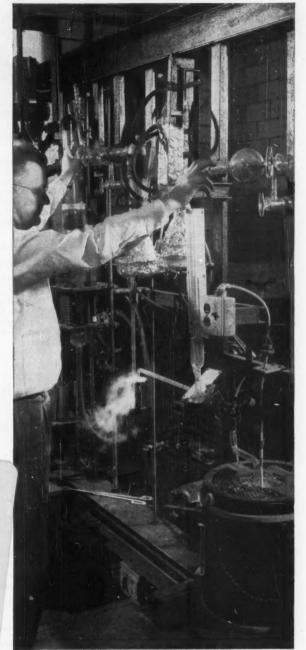
Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

This month's report is on:

### 18-8 STAINLESS

An austenitic, non-magnetic alloy that shows the best combination of creep strength, oil corrosion resistance and oxidation resistance for service up to 1500°F. For use in oil cracking systems, hydrogenation equipment, high temperature oil and steam piping, super heater elements, heat exchanger.

ONE OF	94	Sera.	
DM-2 Silmo DM 2% Cr.Ma	24 TIMKEN HIG Sicromo 2 Sicromo 2½ 2½% Cr1% Mo. Sicromo 3 Sicromo 3 4-6% CrMoTi seamless tubing on le as seamless tubing	Sicromo 5MS Sicromo 7 Sicromo 9M	18-8Ti 16-13-3 25-20*



To help control exact steel analysis, a steel sample is melted in this vacuum fusion apparatus. Then gases are pumped out, and the amount present in the steel is determined.

YEARS ANEAD-THROUGH EXPERIENCE AND RESEARCH



SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

# Here's Force-Balance\* Accuracy and Ruggedness in a Complete Line of Pneumatic Transmitters . . .

#### FLOW, LEVEL, or DENSITY TRANSMITTER-Differential Type



Available with differential ranges as low as  $0-0.6^{\circ}$  H<sub>2</sub>O (ranges this low are exclusive with the Republic Transmitter) and as high as 0-750 psi. Range may be suppressed up to 80% of full scale for density or level measurements.

#### PRESSURE and ABSOLUTE PRESSURE TRANSMITTER



Pressure ranges from 0-1°  $H_2O$  to 0-2000 psi. May be easily adapted for absolute pressure ranges from 0-25 mm Hg to 0-100 psia.

#### FLOW TRANSMITTER-Square Root Extracting Type



Automatically extracts square root function from flow measurements, permitting use of uniformly graduated charts and linear control devices. Available in all standard differential ranges.

#### LIQUID LEVEL TRANSMITTER-Bouyancy Type



Ranges to suit most applications. Can be used to measure level in closed tanks under pressure. Can also measure liquid-to-liquid interface.

#### LIQUID DENSITY TRANSMITTER-Bouyancy Type



Makes continuous density measurement of flowing liquids at line pressures to 300 psi. Fast response.

#### PNEUMATIC or PNEUMATIC-ELECTRIC TRANSMISSION

Special electrical meter body available for use with most Republic Pneumatic Transmitters. Permits locating pneumatic transmitter at metering point to cut piping costs and keep dangerous fluids out of control rooms.

#### for Measuring FLOW — PRESSURE — LEVEL — DENSITY

Republic Pneumatic Transmitters are as simple in operating principle as a laboratory weigh scale—and just as accurate! The only real difference is that forces instead of weights are balanced for a measurement.

This force-balance principle both permits and requires the use of strong, durable construction. That's why Republic Transmitters can be ruggedly built for low maintenance without sacrificing accuracy and sensitivity. Standard models are guaranteed accurate to ½% of full scale.

Range Flexibility — Changing ranges is merely a matter of shifting leverages in Republic Transmitters. Ranges may be changed as much as 2-1 on standard models, as much as 10-1 on double weighbeam models with no change of parts. Suppressed, reversed and compounded ranges are also readily available.

Corrosion Protection — Since process fluids are isolated to a small measuring chamber, special materials may be used for corrosion resistance. Minimum movement of fluid in chamber cuts maintenance when transmitter is used with dirty or viscous liquids.

These are but a few of the many features found in Republic forcebalance Transmitters. Write for a free copy of Data Booklet with all of the details and complete description of various types.

\*In a force-balance pneumatic transmitter, a force produced by the process variable is balanced against a pneumatic pressure. The amount of air pressure required to produce a balance is proportional to the process variable and may be conducted to remote reading instruments or used as the measuring impulse for an automatic controller.

REPUBLIC FLOW METERS CO. • 2240 Diversey Pkwy., Chicago 47, Illinois

# ALUNDUM\*

## High-Purity Fused Alumina

### How can you use it to advantage?

Among the many electrochemically refined materials produced by Norton Company, ALUNDUM fused alpha alumina is one of the most widely useful to industry. Thanks to its inherent properties of hardness, chemical stability and high density, engineers in various fields are finding many new applications for it.

Norton fused alumina is produced in a number of forms. Of these, 38 ALUNDUM\* grain has proved particularly successful in applications demanding high purity. Electrically fused from Bayer-processed alumina, this

white grain is shown by typical chemical analysis to be 99.49% pure Al<sub>2</sub>O<sub>3</sub>. It is insoluble in common solvents and extremely resistant to reduction. It is an amphoteric refractory and has high dielectric strength. Other characteristics include:

 Melting point
 about 3600°F.

 Specific gravity
 3.94

 Crystal structure
 hexagonal system (rhombohedral division)

 Hardness
 9.0 Mohs' scale

 Index of refraction
 1.76 mean

Typical Product Applications in which Norton high-purity fused alumina is now working out to advantage are:

For Catalytic Reactions. Norton fused alpha alumina carriers are outstanding for chemical stability and resistance to abrasion and erosion. Available in the form of spheres, rings and pellets they are used both in fixed bed oxidation reactions and as inert, low-density carriers for space filler applications where a low surface area (less than 1m²/gm) is required. Other types of ALUNDUM catalyst carriers having surface areas in the range 5-60 m²/gm are also available.

In Pebble Heaters. ALUNDUM heat exchange pebbles are giving excellent results in pebble heaters for heating gases above operating temperatures permissible in conventional tube furnaces. Their great resistance to abrasion, impact and repeated heating and cooling make them the ideal heat transfer medium in these devices. Also, their high refractoriness prevents them from the softening and "bridging" together that causes stoppages in the heater's moving bed.

In Thermal Cracking Reactors. Particularly in Wulff Process Generators for cracking light hydrocarbons to produce acetylene gas and Koppers-Hasche Generators for cracking light hydrocarbons to produce a variety of gases and petrochemicals — checkers made of Norton ALUNDUM high-purity fused alumina provide definite advantages. Their excellent heat transfer properties, high refractoriness and resistance to erosion caused by hot gases are important Their ability to withstand the thermal stresses of intermittent operation assures long life. And their purity prevents side reactions with the reacting gases, thus safeguarding product quality.

In Gas Synthesis Generators. ALUNDUM fired shapes are ideal for lining generators of this type. Among the inherent characteristics of Norton high-purity fused alumina that work out very well are: high refractoriness, chemical stability, and inertness that prevents reacting with the contacting atmospheres.

Very many other uses for Norton high-purity fused alumina materials include: pure oxides and sintered refractories, refractory cements, wear-resistant parts, laboratory ware, coatings for rocket and jet plane parts and atomic energy equipment.

#### Other Norton Electrochemically Refined Materials

include CRYSTOLON\* silicon carbide, MAGNORITE\* magnesium oxide, NORBIDE\* boron carbide, FUSED ZIRCONIA and many others, including a number still under development. These high-melting materials, which have varied applications in

many fields, are also the basic ingredients of the famous Norton Refractory R's—refractories engineered and prescribed for the widest range of uses.

#### For Your Own Applications Or Developments

Norton Company not only supplies these materials in crude form, but has extensive facilities for processing and fabricating — and is ready to work with you in engineering materials to your particular requirements. A new booklet "Norton Refractory Grain — Electrochemically Refined" contains detailed information. For your copy, write to

NORTON COMPANY, Refractories Division, 500 New Bond Street, Worcester 6, Massachusetts.



Engineered...R...Prescribed

Making better products...
to make your products better

\*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries



# cuno PORO-KLEAN filter stops 3-to 30-micron particles at 900°F

Cuno's new Poro-KLEAN offers true micronic filtration at temperatures that melt tin, bismuth, cadmium, lead or zinc.

High temperatures, high viscosity, high pressure drops and corrosive fluids don't faze this new filter.

It's all metal-absolutely lint-free. There's no contamination of the fil-

It's strong. Pono-KLEAN filters already in operation take a pressure drop of 1500 psi. Pono-KLEAN porous stainless steel has been used for structural parts in aircraft to achieve boundary layer control and transpiration cooling.

It's corresion resistant. Standard in 316 stainless steel. Low carbon content (0.03 to 0.05% max.) prevents carbon precipitation at welds or during fabrication.

It's easily cleaned—in place, by backwashing with pre-filtered fluid or inert gas; or, when removed, with suitable solvent. May be sterilized with live steam for food or drug processing; or will filter rust and scale from steam used for other cleaning or sterilizing.

Its porosity is closely controlled. Four standard grades cover the range from 3- to 30-micron statistical particle retention.

Standard designs. For most applications standard housings and elements are available.

Get all the facts on Cuno's new Poro-KLEAN filter for your chemical or process applications. Write Cuno Engineering Corporation, 31-1 South Vine Street, Meriden, Conn.



THIS PORO-KLEAN FILTER handles 180 gpm of naphtha at 400°F. Operating pressure: 700 psi ASME Code with 5 psi pressure drop. It's cleaned by back-flushing with nitrogen. Cell-type Poro-Klean filter elements (large picture at top) have large surface area. This unit is 54" L x 9" O.D. and is designed for 1500 psi pressure drop and 550°F.



ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (edge-type) - MICRO-KLEAN (fibre cartridge) - FLO-KLEAN (wire-wound) - PORO-KLEAN (porous metal)

# NH3 Storage SYSTEMS

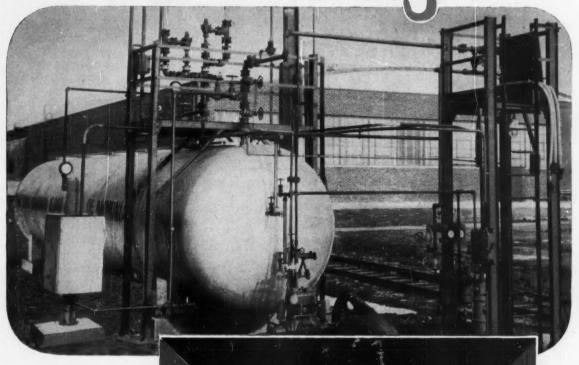


Illustration of typical outdoor installation of 15,000 Gallon Ammonia Storage System.

Drever Company offers years of experience in designing and installing unloading and storage facilities for handling anhydrous ammonia.

Systems tailored to meet individual plant requirements.

RED LION ROAD AND PHILMONT AVE.

BETHAYRES PA.

## X

### Check list for LITHIUM Researchers—No. 2

Lithium has enabled industry after industry to achieve over-all savings through shortcuts, reduction of waste, improvement of end-product, and simplification of operating procedures. Check your field of interest in Lithium below. If you are interested in a spe-

cific application relative to Lithium not indicated in the checklist, note the fact in the form furnished, attach it to your letterhead and send it to us. Our research laboratory will look into the matter for you.

#### LITHIUM COMPOUNDS

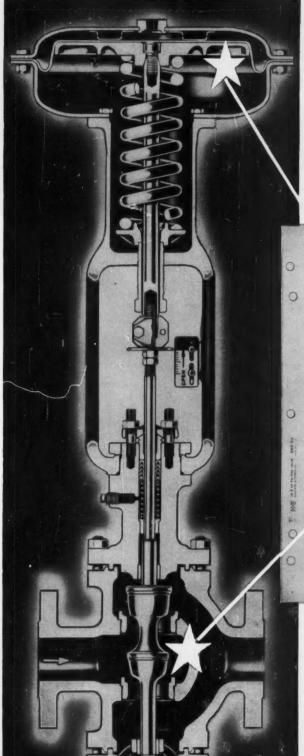
Uses:    Storage batteries   Gas absorption   Pharmaceutical chemicals   Multi-purpose greases   Lubricating oils   Lithium salts     Lithium BROMIDE Uses:   Air Conditioning   Pharmaceuticals   Gas absorption   Lithium Silicate Uses:	Gas absorption Air conditioning Welding rods Brazing fluxes Lithium metal Heat treating salts Deicer fluid  LITHIUM NITRATE Uses: Refrigeration Heat treating salts
Gas absorption Pharmaceutical chemicals Multi-purpose greases Lubricating oils Lithium soils  LITHIUM BROMIDE Uses: Air Conditioning Pharmaceuticals Gas absorption  LITHIUM SILICATE Uses:	Air conditioning Welding rods Brazing fluxes Lithium metal Heat treating salts Deicer fluid  LITHIUM NITRATE Uses: Refrigeration Heat treating salts
Uses: Air Conditioning Pharmaceuticals Gas absorption  LITHIUM SILICATE  Uses:	Uses:  Refrigeration Heat treating salts
Air Conditioning Pharmaceuticals Gas absorption  LITHIUM SILICATE  Uses:	Refrigeration Heat treating salts
Pharmaceuticals Gas absorption  LITHIUM SILICATE  Uses:	☐ Heat treating salts
Uses:	LITHIUM TITANATE
	Uses:
Titanium porcelain enamels Glazes for sanitary ware Pottery glazes	☐ Titanium porcelain enamels ☐ Ceramic glazes ☐ Electric porcelains
LITHIUM ZIRCONIUM SILICATE	LITHIUM ALUMINATE
Uses:	Uses:
Ceramic glazes Electric porcelains	☐ Flux in highly refractory enamels
LITHIUM MOLYBDATE	
Usac	
As smelter or mill addition in white enamel cover	
	for
(Compound, Metal or Derivative)	
	LITHIUM MOLYBDATE  Uses: As smelter or mill addition in white enamel cover  (Compound, Metal or Derivative)

MINES: Keystone, Custer, Hill City, South Daketa • Bessemer City, North Carolina • Cat Lake, Manitoba • Ames Area, Quebec • BRANCH SALES OFFICES: New York
Pittsburgh • Chicago • CHEMICAL PLANTS: St. Louis Park, Minnesota • Bessemer City, North Carolina • RESEARCH LABORATORY: St. Louis Park, Minnesota

checklist. They will be sent as checked above.

... trends ahead in industrial applications for Lithium

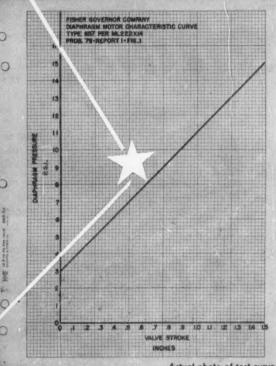
MINNEAPOLIS 2, MINN.





# Improved Design

### DIAPHRAGM **MOTOR VALVES**



Actual photo of test curve

#### **NEW SUPER STRUCTURE PROVIDES LINEARITY OF OPERATION**

Special molded diaphragm, in combination with deep casing, provides constant diaphragm effective area. Resultant linear relationship between input signal and inner valve position makes flow versus diaphragm pressure characteristic of control valve identical to flow versus lift characteristic.

#### FISHER GOVERNOR COMPANY

MARSHALLTOWN, IOWA

Woodstock, Ontario.

ANNIVERSARY

# Tableted

strong



as rock

TO



whatever you specify

## Typical Harshaw Catalysts:

Aluminum Chloride

Anhydrous Boron Trifluoride

Boron Fluoride Addition Compounds

Hydrofluoric Acid Alumina—active or inert Molybdena Alumina Tungsten Alumina Cobalt Molybdena

Copper-Chromium Oxide

Magnesia Nickel

Zinc-Chrome

Vanadium

# Harshaw Catalysts available in these forms:

Tablets

Powders

Rings Granules

#### Use Harshaw Catalysts for these processes: Extrusions

Hydroforming Cyclization Oxidation

Dehydrogenation Hydrogenation Dehydration

Alkylation Isomerization

Harshaw Catalysts—made exactly to your specifications of raw materials, chemical composition, and physical properties such as length, diameter, crushing strength, abrasion resistance, bulk density, etc. AND delivered when you want them!

Harshaw has the know-how-we pioneered in making customer specified catalysts. Harshaw has the facilities—we produce carloads every week!

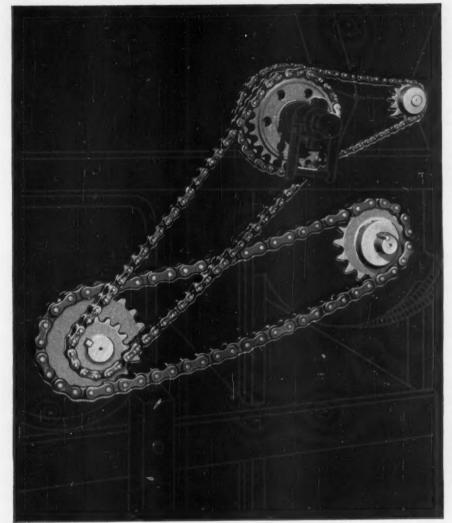
We are to you like the druggist is to the doctor . . . write your catalyst prescription and depend on Harshaw to fill it.

Our free booklet "Harshaw Catalysts" is yours for the asking. Write today.

#### The HARSHAW CHEMICAL Co. CLEVELAND 6, OHIO

CHICAGO . CINCINNATI . CLEVELAND . DETROIT . HOUSTON . LOS ANGELES HASTINGS-ON-HUDSON . PHILADELPHIA . PITTSBURGH

# In roller chain ... EXTRAS\* like these give you extra reliability

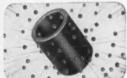




plied on a range of sizes) end a cause of stiff chain.



PRE-STRESSING of multiple width chain provides uniform load distribution.



SHOT-PEENED ROLLERS have greater fatigue life, added ability to withstand impact.



CLOSER HEAT-TREAT CONTROL — coupled with rigid testing insures uniformity.

#### \*And you pay no premium for these LINK-BELT extras

Big reason why Link-Belt Precision Steel Roller Chain is first choice for so many tough jobs is that it has extra reliability built-in. For example, pre-stressing smooths out any irregularities of multiple width chain in advance. And it's just one of many extras you get as standard from Link-Belt. Check the three others shown here. Then call the Link-Belt office or authorized stock carrying distributor near you for facts on Link-Belt's complete range of roller chain and sprockets. Data Book 2457 gives full information on single and multiple widths, in ½" to 3" pitch, 1" to 3" double pitch. Ask for your copy.



ROLLER CHAIN & SPROCKETS

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Austria, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

NEW SIMPLICITY

FOR LIQUID LEVEL

with the new FOXBORO
Type 13LA pneumatic LEVEL TRANSMITTER

#### MEASUREMENT!

Easy Low-Cost Installation on any closed or open tank. Only two small pressure taps required. Nothing inside tank!

Fully-Adjustable Ranges . . . 0-20" to 0-80" and 0-50" to 0-250" H2O.

Complete adjustment for elimination of outside leg effect gives forward-reading signal to any standard receiver!

**Highest Sustained Accuracy...** Instant, precise response to level changes even under extreme operating conditions.

Rugged and Corrosion-Resistant... Level-sensing element is Type 316 stainless steel, silicone-filled "capsule" diaphragm applicable on static pressures up to 1500 lbs.

There's nothing simpler for accurately measuring liquid level than the Foxboro Type 13LA d/p Cell\* Liquid Level Transmitter! No floats, knife edges, stuffing boxes, or complicated hook-ups. A simple, direct piping job connects it to the tank... operates in any position, even upside down. The Transmitter precisely measures difference in head caused by level change... sends 3-15 psi air signal over single air line to indicator, recorder, or controller, It's easily traced when required,

up to 250°F., to maintain fluidity of liquid.

The 13LA d/p Cell Transmitter is low in initial cost, requires practically no maintenance. In addition, it is easily converted in field for the measurement of fluid flow. It's the ideal instrument for heavy industrial applications . . indoors or out. For complete details, ask your nearest Foxboro Sales Engineer, or write for new Bulletin 13-22 to The Foxboro Company, 361 Neponset Ave., Foxboro, Mass., U.S.A.

\*Reg. U.S. Pat. Off.

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND



LIQUID LEVEL TRANSMITTER

#### BETHLEHEM AT BEAUMONT

The Nation's Leading Builder and Converter of Waterborne L.P. Gas and Ammonia Vessels



S.S. Natalie Warren, converted to L.P. Gas Carrier. Water capacity 38,000 barrels.



S.S. Ultragaz, converted to L.P. Gas Carrier. Water capacity 17,100 barrels.



Ammonia Mariner, seagoing Anhydrous Ammonia Barge. Water capacity 721,270 gallons.



Esso Viru, oceangoing L.P. Gas Barge. Water capacity 220,000 gallons.



Panama City, rivergoing L.P. Gas Barge. Water capacity 393,000 gallons.



Port Everglades, oceangoing L.P. Gas Barge. Water capacity 550,000 gallons.

These craft are indicative of Bethlehem's activities in the construction and conversion of specialized vessels for the economical and dependable waterborne transportation of L.P. Gas and Anhydrous Ammonia. If you have a problem involving the shipment of these or other petro-chemical products, we may be able to help you. Your inquiries will receive prompt attention.

# S H I P R E P A I R Y A R D S Boston Harbor Baltimore Harbor Los Angeles Harbor San Francisco Harbor

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Quincy, Mass.
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# BETHLEHEM STEEL Shipbuilding Division

GENERAL OFFICES: 25 BROADWAY, NEW YORK 4, N. Y.
On the Pacific Coast shipbuilding and ship repairing are performed by
the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation





# WILLIAMS Reversible HAMMER MILLS

Double service from hammers, breaker plates and grate bars—maintenance reduced to half or less—downtime cut as much as 50%—these are only a few of the money-making, time-saving features of Williams Reversible Hammer Mills.

Operation either clockwise or counter-clockwise with a reversible motor promises that hammers and other internal parts will work twice as long without even opening the machine. Slower and more even wear results in continuous peak output of a uniformly high quality product while, at the same time, demanding the very minimum of time and expense in the replacement of worn parts.

Reversible manganese breaker plates also give twice the usual length of service, and are adjustable to compensate for hammer wear to maintain original close settings.

For the most in real operating economy, high production and top quality products, get the facts about Williams Reversible Hammer Mills. Write For Catalog.

WILLIAMS PATENT CRUSHER & PULVERIZER CO. 2706 N. Ninth St. St. Louis 6, Mo.



Impactors Helix-Seal Mills Roller Mills Air Separators Vibrating Screens Feeders
OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

Open view of Reversible Hammer Mill. Note heavy shock-proof, wear-resistant manganese steel liners and breaker plates, and the rugged, reinforced construction. Entire interior easily, quickly accessible. Rotor removable without disturbing feeder or feed chute.



# News about COATINGS for METALS MANNIE CONTRACTOR PROTECTION

# Two new corrosion-blocking materials join UCILON Coating Systems

# Sprayable plastisol gives extra thick film in one coat

Unichrome Coating 5300 makes the spraying of vinyl plastisols a practical and easy matter. It's the first plastisol that can be successfully used even on a cold vertical metal surface, if that surface can be uniformly baked afterwards. No longer need these thick resinous materials be restricted to metal equipment of dippable size.

Coating 5300 builds a protective film 20 mils thick in one coat, or thicker in multiple coats. Multiple coats can often do many of the jobs for which sheet materials are used, such as tank lining. Coating 5300 assures protection free from pores or seams, and with the inertness of vinyls to a broad range of chemicals and corrosives.

Bulletin VP-1 gives more information — send for it.

# Internal protection for steel drums

The requirements for a lining material for steel drums are clear cut. The lining has to prevent corrosion, prevent contamination, withstand constant contact with the product being packaged and have the right physical properties for this rough and tumble service.

By applying its knowledge of protective coatings, United Chromium has developed many types of linings to meet the needs of a tremendous variety of processed products. Unichrome vinyl, phenolic, plastisol and epoxy formulations can handle most jobs economically and reliably.

#### UNITED CHROMIUM DIVISION

METAL & THERMIT CORPORATION

100 East 42nd Street, New York 17, N. Y. Waterbury 2D, Cenn. • Detroit 20, Mich. East Chicago, Ind. • El Segundo, Calif. In Canada:

United Chromium Limited, Toronto 1, Ont.



Ucilon Coating 1901, 1951 and 458 add advantages of neoprene base materials and vinyl-Thiokol compound to available Ucilon Coatings—some of which are shown here.

Virtually all successful chemical resistant coatings now represented in the group . . . one of the widest available

Neoprene coating systems and a special modified vinyl system have joined up with the 16 other Ucilon\* Coating Systems that stop hundreds of severe corrosives.

Nineteen specialized Ucilon protective coating systems now available give engineers a formidable arsenal with which to combat corrosion. The wide array permits a choice of system best suited to the corrosive, to the service conditions, to the type of equipment or structure to be protected.

#### HEAVY FILMS WITH FEW COATS

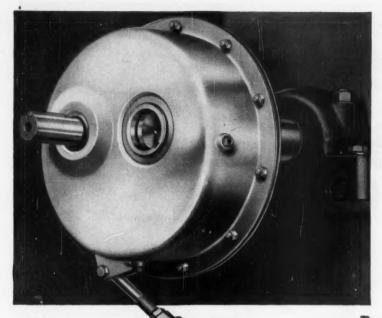
Ucilon Coating 1901 is the air-drying neoprene material designed for general maintenance against corrosive fumes. It gives a 6½ mil film in 3 coats. Ucilon Coating 1951, in the same neoprene group, offers a catalyzed topcoat for protection against corrosive solutions.

#### COMBINATION OF CHEMICAL RESISTANCES

A system based on newly formulated Ucilon 458 combines the advantages of both vinyl and Thiokol materials. The coating has a broadened range of applicability, giving a thick film that resists strong chemicals as well as petroleum derivatives.

#### FOR THE TOUGH MAINTENANCE PROBLEMS

In the large group of Ucilon Protective Coating Systems, engineers can now get the protection required from a choice of practically every successful corrosion controlling coating — including vinyls, vinyl-Thiokols, neoprenes, chlorinated rubber, phenolic and fish oil type coatings. There are proved, economical coatings for acids, alkalies, other strong chemicals, salt solutions, oils, wetting agents and more. Bulletin MC-9 gives details. Send for copy.



SIX SIZES • 1/2 to 30 hp

· Single or double

reduction

Wide output

speed range -

420 to 10 rpm

# FALK

ALL-STEEL

#### **Shaft Mounted Drives**

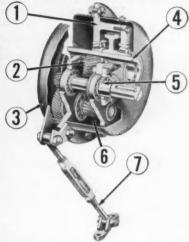
#### simple-compact-rugged-efficient

Created specifically for the vast number of applications demanding a sturdy and compact speed-reducing unit for direct mounting on the driven shaft, the new Falk all-steel Shaft Mounted Drive is built to give long service life at substantial savings of space, time, power and maintenance costs!

This efficient helical-gear drive, latest in the unmatched list of Falk precision-gearing achievements is an ingenious modification of the time-tested Falk Motoreducer design which has held, for more than 20 years, recognized leadership in this branch of highest-quality power transmission . . . It complements and completes the world-famous Falk line of reduction units covering the entire range of industrial applications.

Investigate the Falk all-steel Shaft Mounted Drive. Write to Department 247 for engineering bulletin, including selection and dimension details.

#### These famous FALK "In-built" factors mean long life and dependability...



- 1 All-steel Frame, with more than double the rigidity of iron, supports all rotating elements.
- 2 Precision Helical Gears, designed and machined by Falk, rated to AGMA standards.
- 3 Pressed Steel Housings, whose sole function is to keep oil in, dirt out; easily removed for gear inspection without dismounting unit.
- 4 Through Hollow Shaft with counter bore provides for easiest installation or removal from driven machine shaft extensions.
- 5 Backstop can be furnished with the unit or added later for positive prevention of reverse rotation.
- 6 Positive Lubrication, continuous direct dip of revolving elements at all speeds.
- 7 Tie Rod and turnbuckle serve as anchor and facilitate V-belt or chain adjustment.

#### A FEW TYPICAL APPLICATIONS



**BUCKET ELEVATOR** 



APRON FEEDER



SAND CLASSIFIER



BELT CONVEYOR

#### THE FALK CORPORATION, Milwaukee 8, Wisconsin MANUFACTURERS OF

- Motoreducers
- Speed Reducers
- Flexible Couplings **Shaft Mounted Drives**
- High Speed Drives
- Special Gear Drives
- Single Helical Gears • Herringbone Gears
- Marine Drives
- Steel Castings
- Contract Machinina

... a good name in industry





On the right are pictured nine cereal and flour bins built for General Mills' newly expanded packaged foods plant on the Buffalo River. These were shopfabricated by Graver to add important new capacity at this location.

Graver is skilled at building bins and industrial silos to precise specifications. Unusual sizes, special metals, intricate designs-all these are grist to Graver's know-how and years of experienced, specialized fabrication.

To solve your storage problems, consult Graver-a recognized fabricator for industrial storage.

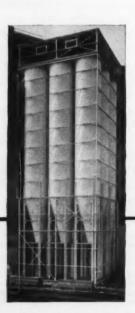
#### GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

CHICAGO • NEW YORK • PHILADELPHIA • EDGE MOOR, DEL. CATASAUQUA, PA. • PITTSBURCH • CLEVELAND • DETROIT • TULSA SAND SPRINGS, OKLA. • HOUSTON • ODESSA, TEXAS • CASPER, WYO. LOS ANGELES • FONTANA, CAL. • SAN FRANCISCO



GRAVER ... Storage equipment for all industries



Here's what you get when you specify Kaiser Alumina!



1. Immediate, individual attention to your order!



THESE ARE important reasons why Kaiser Chemicals has become a major supplier of aluminas.

Whether you manufacture abrasives, glass, ceramics, refractories, catalysts, or chemicals for water treatment, we have the product and the experienced technical service to meet your needs exactly.

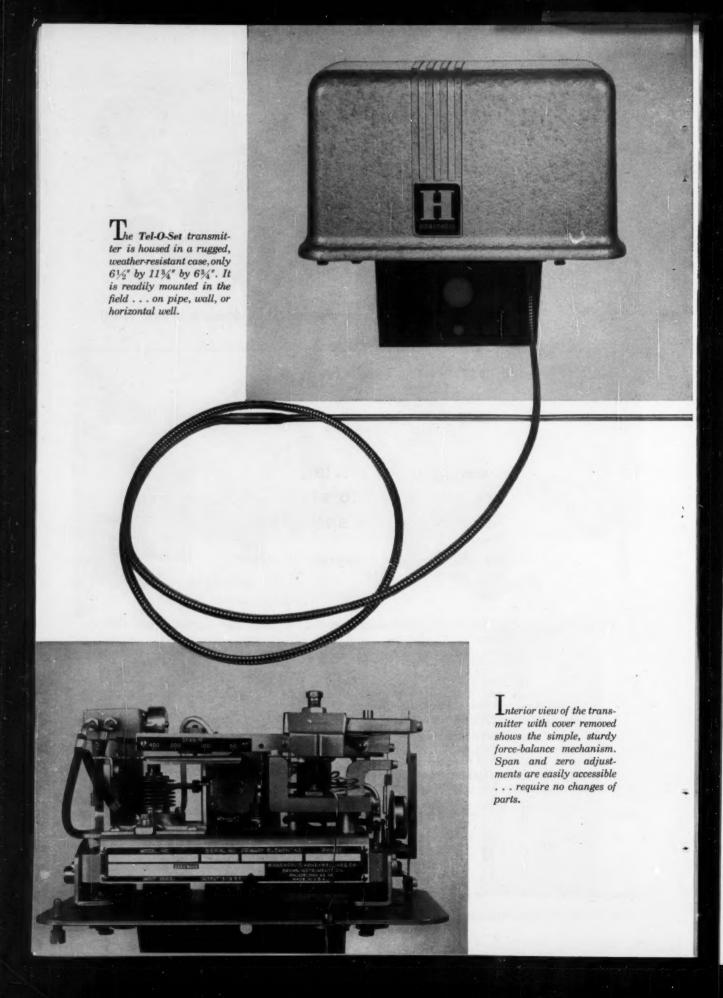
Call or write Kaiser Chemicals Division, Kaiser Aluminum & Chemical Sales, Inc. Regional Sales Offices: 1924 Broadway, OAKLAND 12, California...Three Gateway Center, PITTSBURGH, Pa...518 Calumet Building, 5231 Hohman Ave., Hammond, Indiana (CHICAGO).

# Kaiser Chemicals

active, calcined and hydrated aluminas

Aluminas • Refractory Bricks and Ramming Materials • Dolomite • Magnesia • Magnesite • Periclase

CHEMICAL ENGINEERING—January 1956



# Compare it!

The same *Tel-O-Set* Transmitter can be used for temperature, absolute pressure or gage pressure—in all ranges

Changeover is simple...takes little time and labor. And, there's no need to stock an assortment of thermal systems or spring assemblies.

#### Tops in performance, too . . .

In accuracy • In speed of response • In ambient temperature and pressure compensation • In resistance to vibration • In durability • In ease of adjustment and calibration • In operating economy

Span can be adjusted to any values between 20 psi or  $50 \, \mathrm{F}$  minimum, and  $150 \, \mathrm{psi}$  or  $400 \, \mathrm{F}$  maximum. Without changing parts, the span can be shifted to cover any part of the overall transmitter range . . . from -375 to  $+1000 \, \mathrm{F}$ , or from 40 to  $550 \, \mathrm{psi}$ .

This multi-purpose instrument will simplify the training of your operating and maintenance men . . . reduce spare parts inventory. And a single instrument does double duty as a standby replacement for either temperature or pressure applications. Its sturdy, corrosion resistant mechanism assures long service life.

Your local Honeywell sales engineer will be glad to discuss how the *Tel-O-Set* transmitter . . . and related *Tel-O-Set* miniature indicators, recorders and controllers . . . can work for you. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

• REFERENCE DATA: Write for Bulletin 7280, "Tol-O-Ser Transmitters."



Honeywell
BROWN INSTRUMENTS

First in Controls

#### Wagner

New NEMA Frames Standard and Explosion-proof



## **Wagner Totally-Enclosed Fan-Cooled Motors**

#### cut maintenance time and costs

Check the features of the new Wagner Type EP Totally Enclosed Motor. They spell the difference between needless expenditures in maintenance time and costs . . . and a definite savings in motor upkeep and repairs. You'll find that for general industrial use where dust, dirt, filings, abrasives, steel chips or moisture are present, the Wagner Type EP Motor gives steady, troublefree performance and longer service life.

Wagner Type JP Explosion-Proof Motor . . . has the same quality construction as the Type EP - plus added features which make it completely safe to operate where explosive dust, gases or vapors are present.

Both Type EP and JP Wagner motors are available in ratings up to 250 horsepower. For complete information, just call the nearest of our 32 branch offices, or write for Bulletin MU-203.

Wagner Electric Corporation 6407 Plymouth Ave., St. Louis 14, Mo.



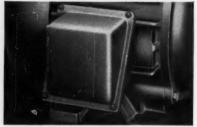
1 HEAVY-DUTY BALL BEARINGS-Highest quality bearings of more than ample capacity provide long,



2 BEARINGS CAN BE RE-LUBRICATED-Wagner motors can be re-lubricated when necessary to prolong



3 BEARINGS STAY (LEAN—Both ends of these motors are equipped with running shaft seals, a machined collar mounted on the motor shaft.



4 EASY TO CONNECT—Large diagonally-split conduit box provides ample room for making connections. Leads are permanently identified.

5 NO GREASE LOSS—Bearing housings have effective seals to prevent escape of grease.

6 RIBBED FRAME—Ribs on the corrosion-resistant cast iron frames add mechanical strength and increase the surface area for more efficient cooling.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS - TRANSFORMERS - INDUSTRIAL BRAKES - AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

M55-18

EXON: each resin engineered for a specific problem



**EXON 481** 

specifically for

# CONSTRUCTION COATINGS



Firestone EXON.

Site application of colorful, abrasionproof coatings that last is now possible with the development of EXON 481 resin.

Simply sprayed on by a gun with 60 lbs. pressure over a prime coat, the stainproof, scuffproof sheeting dries the instant it is applied. Application is so quick and easy that the most complex shapes are no problem. No loose ends, seams, laps or joints.

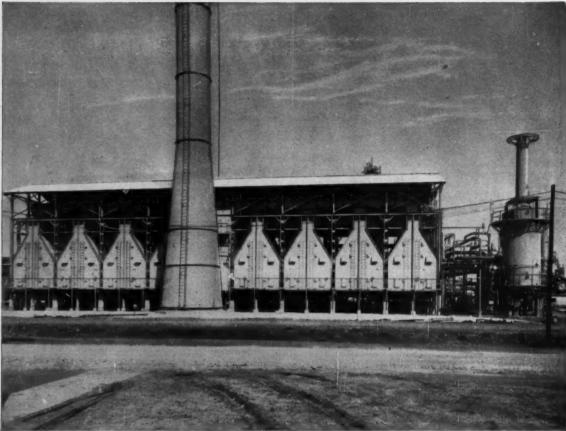
EXON 481 has exceptional tensile strength — over 1000 lbs. per square inch with an elongation factor up to 200%. It is soluble in ketones, compatible with plasticizers, stabilizers and all pigment types.

As a result, coatings of the most decorative, attractive colors can be formulated. All completely washable, they ruggedly resist fading or cracking.

For complete information or technical service on Exon 481 and on all the resins in the ever-growing Exon line, call or write:

#### CHEMICAL SALES DIVISION

FIRESTONE PLASTICS COMPANY, DEPT. 628C, POTTSTOWN, PA. DIVISION OF FIRESTONE TIRE & RUBBER CO.



200 million pounds of Ethylene can be produced yearly by this bank of eight ethane cracking furnaces at the Tuscola, Illinois plant of National Petro-Chemicals Corporation, (a joint enterprise of National Distillers Products Corporation and Panhandle

Eastern Pipeline Company). Largest single installation of its kind to date, these furnaces, operating above 1500F°., produce ethylene by cracking ethane in Incoloy tubes.

# Incoloy tubes perform successfully in hydrocarbon cracking furnaces

The Incoloy\* tubes in the ethane cracking furnaces shown above have now given two years satisfactory service — with promise of more to come. Operating temperatures are in excess of 1500°F. A number of installations in other plants have given as much as four years' service in cracking ethane and propane for production of ethylene.

The reasons? Incoloy has high creep and rupture strengths at elevated temperatures. It resists carburization and is stably austenitic. After prolonged exposure to intermediate temperatures, Incoloy shows only slight tendency to become embrittled by carburization and none at all due to structural changes.

You can use Incoloy at temperatures right up to 1800°F. And it gives an improved safety factor in decoking where temporary hot spots may occur,

#### Incoloy offers economy

In addition to improved performance features, Incoloy also offers a decided price advantage, compared with certain alloys, when it is used as extruded tubing.

Comparatively low thermal expansion and good weldability are other characteristics that make Incoloy an attractive material for this application.

If the severe conditions involved in hydrocarbon cracking or in natural gas reforming are a problem to you, why not consult our High Temperature Engineering Section? They will be glad to help you without cost or obligation.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

\*Registered trademark of The International Nickel Company, Inc., applied to a nickel-chromium-iron alloy produced and marketed by it.



Incoloy

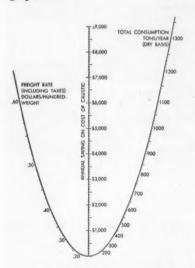
## BRIEFS

### for buyers of

# Caustic Soda Paradichlorobenzene Muriatic Acid

#### 50% to 73% — some save, some don't

Like to settle once and for all whether you can save by switching from 50% to 73% liquid caustic soda? Simply draw a line on this nomograph.



Start at your freight rate and draw to your annual consumption in tons, dry basis. Your approximate savings on freight will appear where you intersect the center line.

From this figure, subtract annual depreciation for dilution equipment. (We'll be glad to advise you on cost of this equipment.)

If you still show a saving, it would be wise to consider the big switch seriously. For more facts on the economics of 50% and 73% caustic, check the coupon for a copy of our pocket-size Caustic Soda Buyer's Guide. And for specific technical advice centered on your requirements, just phone or write the nearest Hooker sales office.

#### The great moth hunt

Some of our forward-looking customers are busily getting set for those spring days when the housewives of the country decide to put away their woolens and furs until next winter.

To satisfy that market, you can offer a product unsurpassed in whiteness and dryness. That product is Paradi®

We're almost unbelievably fussy about paradichlorobenzene. We make it in seven different sizes. Each size has its advantages, which you can learn by reading our Bulletin 454.

We manage to get PARADI so pure that it sublimes completely in use leaving no residue, not even an odor!

This persistence seems to pay off. Users, who frequently sample the field, tell us Paradi is tops for repackaging, and the sparkling crystals make a firm, dry, non-oozing block or pellet of exceptional whiteness and brilliance.

If you're preparing to wage commercial war on moths, why not look into the convenience of Paradi's seven sizes?

To get Bulletin 454, check the coupon. For 1-lb. samples of Paradi, write us on your business letterhead.

#### How to arrive at a happy HCI solution

For help in figuring your muriatic acid needs, send the coupon for our technical data sheet on this product.

It tells at a glance the amount of muriatic acid you need to make up various vomes of different Baumé solutions.

The same data sheet gives advice on the safe handling of muriatic acid, and lists the characteristics of Hooker muriatic

"Hooker White" is a grade of muriatic acid that's probably one of the purest you can buy in volume anywhere. It's free of arsenic, contains no more than .003% sulfates, .0001% iron. Like Hooker's standard grade, "Hooker White" is shipped in 13-gallon glass carboys and rubberlined tank cars. 18°, 20°, and 22° Baumé.

For a sample of either "Hooker White" or standard, write us on your business letterhead.

### Check items you'd like to receive:

- ☐ Caustic Soda Buyer's Guide. Lists advantages of 50% and 73% solutions; comparative costs; capacities of tank cars and other containers; useful shipping information.
- ☐ Bulletin No. 454. Helpful information on PARADI: for repackagers and processors.

Keep your file up-to-date with technical data sheets on these Hooker chemicals:

- ☐ Caustic soda (standard grade)☐ Caustic soda (rayon grade)
- ☐ Paradi (Hooker paradichlorobenzene)
- ☐ Muriatic acid

Clip and mail with your name, title, and address.



-From the Salt of the Earth-

HOOKER ELECTROCHEMICAL COMPANY

5 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.

D FORTY-SEVENTH ST., MIAGARA FALLS, M. T.
MIAGARA FALLS - TACOMA - MONTAGUE, MICH. - NEW YORK - CHICAGO - LOS ANGELES

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No more clogged conveyors, product losses, dusty workrooms or disgruntled inspectors when you rely on Fuller conveying systems to move dry pulverized or granular materials from Receiving to Storage to Process, thence to Shipping.

The right combination of Fuller-Kinyon, Airseyer, Airse

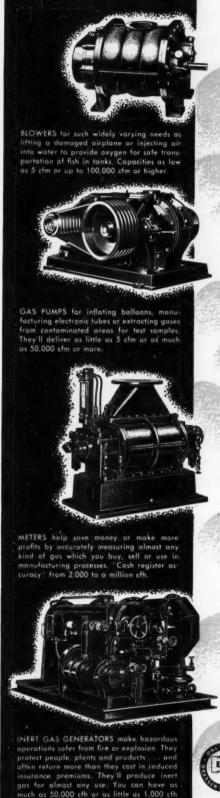
The right combination of Fuller-Kinyon, Airveyor, Airslide and Fuller-Fluxo systems, engineered by Fuller and installed in your plant, will end forever the chances you may have been taking with product contamination. Completely enclosed Fuller systems keep out all foreign matter, speed transport of dry materials in bulk from Receiving and throughout your plant.

First step toward improved plant cleanliness: write for Fuller's informative brochure, "How to Pull Dollars Out of Thin Air." Do it today.





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New ways to put air (or gas) to useful, profitable work are constantly being developed by engineers and designers. These result in more effective machines and devices - frequently replacing slower or more expensive methods-often reducing the first cost of the equipment itself. These results are accomplished . . .

### by resourceful engineering

In many of these applications, designers and engineers have utilized standard R-C equipment, sometimes with special adaptations. The problem may call for a small or large volume of air, moved by R-C Blowers or Exhausters. It may require vacuums, produced by R-C Vacuum Pumps. Perhaps metering or pumping of gas is needed, also met by R-C products. In any event, the solution is often . . .

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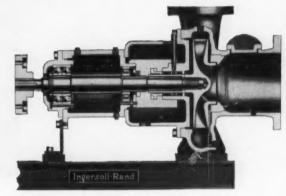
Radically new type of centrifugal pump handles a variety of industrial liquids, even the most difficult, without clogging or air binding

Not just a modified centrifugal pump, the new Ingersoll-Rand Class EL, EM and EH Pumps feature a radically new and patented construction which makes them non-clogging, non-vapor-binding, self-venting and self-priming.

Foamy solutions containing up to 50 percent entrained air or gases can be pumped continuously without danger of losing prime or vapor binding. And viscous liquids or mixtures with exceptionally high solids content can be handled with equal ease—with complete freedom from clogging.

Crystals or other solids in suspension can be pumped without injury. And with any type of liquid, the pump will maintain its prime even when the suction piping is uncovered or exposed to the air.





Section through Class 6EH pump, showing the patented construction

These heretofore unattainable performance characteristics result from the unique diverging impeller design in which the area at the exit is much greater than at the inlet. Hence the material pumped cannot enter in sufficient quantity to replace the ejected liquid and a vacuum space is created between the blades. Unlike the ordinary centrifugal pump, conversion from velocity to pressure is accomplished in the impeller as well as the casing and the relative velocities are considerably lower. This reduces impeller wear when handling liquids with high solids content.

Field experience with the new EL, EM and EH pumps has conclusively proved their ability to handle the toughest pumping jobs. In actual service, they are pumping solutions that no other centrifugal pump could handle without air binding or clogging.

If you have a liquid moving problem that's too tough for an ordinary pump, this new I-R Pump offers a practical, low-cost solution. Sizes available for capacities from 200 to 7000 gpm, heads to 225 ft. For complete details, send today for your copy of Bulletin 7325.

Ingersoll-Rand

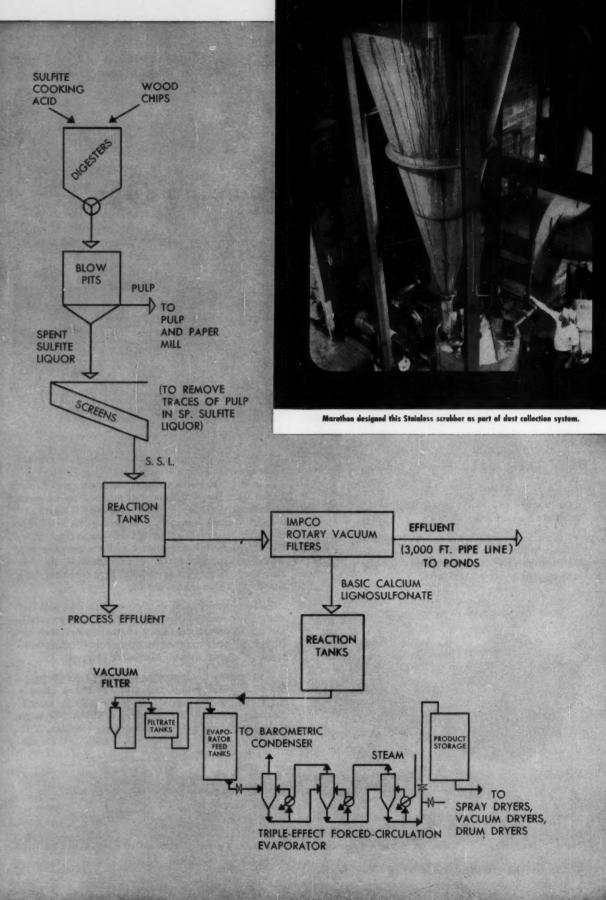


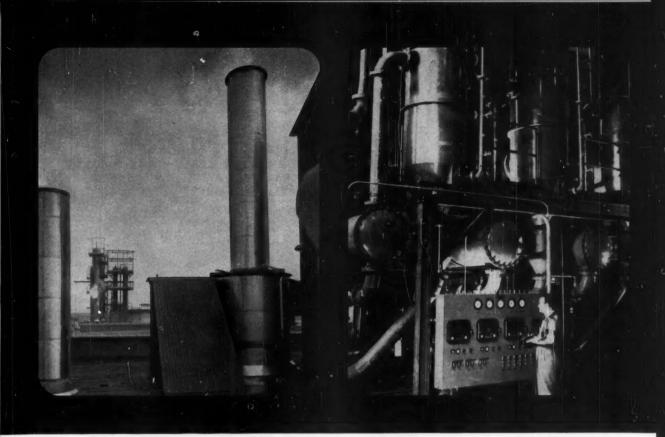
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PUMPS . COMPRESSORS . CONDENSERS . VACUUM EQUIPMENT . GAS & DIESEL ENGINES . ROCK DRILLS . AIR & ELECTRIC TOOLS

CHEMICAL ENGINEERING-January 1956

75





Stainless Steel stacks vent corresive liquid from dryers.

Operator checks controls on Stainless Steel evaporator.

## How sulfite liquor waste is turned into profit with the help of Stainless Steel

At its sulfite mill in Rothschild, Wis., the Marathon Corporation produces more than 50,000 tons of cellulose fibers per year. In the 1920's, Marathon started an intensive research program aimed at reducing river pollution from the spent sulfite liquor and recovering the 50% wastage of organic solids that resulted.

By fractionating the sulfite liquor, valuable lignosulfonates could be produced; but it was strictly a laboratory operation because the highly acid liquor corroded all normal materials—until Stainless Steel became available in the early 1930's.

Since it was completed in 1936, the new plant processes all the effluent from the Rothschild plant; and it

has a capacity of 75 million pounds a year. It is the only plant in the world completely devoted to the production of fractionated lignosulfonates and approximately 50% of the equipment is made from Stainless Steel. This includes thousands of feet of 6-inch tubing, storage tanks, rotary vacuum filters, evaporators and dryers. Much of the Stainless is type 304 or 316. And much of it has been in continuous service for 15 years, compared to previous materials that disintegrated after 18 months.

When designing new process equipment, frequently nothing will save more money than the careful use of long-life Stainless Steel. For service-tested quality, specify USS Stainless Steel.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
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Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.



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### iron body gate valves

with screwed or flanged ends

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### . 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.



Brass Liner on Glands assures greater resistance to corrosion and scoring.

### WALWORTH

valves and fittings

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DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents lopsening of disc by corrosion.



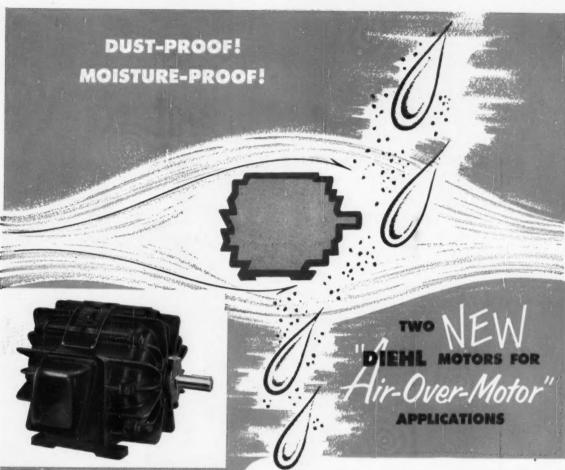
Bronze Back-Seat Bushings in bonnets of OS&Y valves.



Solid Web Type Disc in OS&Y valves for greater strength and longer service.



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Tops in Quality—

### Tops in Quality - Competitive in price!

When you buy or specify motors for fans, blowers, unit heaters, air conditioners, cooling towers or dehumidifying systems don't overlook these two new standard or customdesigned Diehl Totally-Enclosed Motors.

Smaller in size, lighter in weight, precision-engineered and precision-built to new NEMA standards, they are ideally suited to "air-over-motor" applications where moisture, fumes, dust and other airborne particles

are a problem ... a field in which Diehl has long been a leader.

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Electrical Division of THE SINGER MANUFACTURING COMPANY Finderne Plant, SOMERVILLE, N. J.

Please send me the following bulletins:

- ☐ New Type "D" Motor Bulletin No. CE-3304
- Consolidated Catalog & Price List No. CE-3310

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INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES



### **Ready for Some High-Pressure Business**

Here's a rugged forged converter that will be used in the making of ammonia. It's a husky brute; weighs just about 48 tons. Even those nuts on the head are tremendous, each weighing 77 lb. The vessel has an overall length of 22 ft, and its ID and OD are 30 in. and 45 in. respectively. It has been hydrostatically tested to 15,000 psi.

Like all Bethlehem vessels of this type, it was forged, treated, machined, and assembled entirely in our shops; made from first to last under the watchful eyes of Bethlehem technicians. It is an excellent example of what we can build to customer specifications.

Bethlehem forged pressure vessels are seamless units made with any desired thickness of wall. They can be furnished in either carbon or alloy steels, and in any required size. Many we have built are giants; others are so small that they would classify as midgets.

Call us whenever you need new autoclaves, reactors, converters, separators, filters, accumulators, or other types of forged-steel vessels. No matter how detailed your specifications, our shops can handle them fully.

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Reverse Jet Dust Filter

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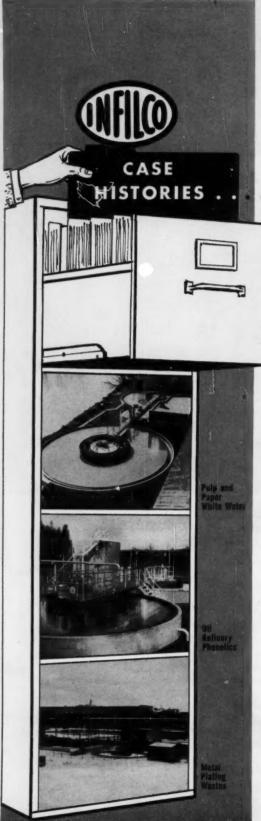


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INFILCO equipped plants effectively apply these fundamental treatment operations to liquid wastes produced during varied industrial processes.

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5541

# Hard-boiled acids can't corrode Aloyco "Hastelloy" Valves

The fight against corrosion by hot mineral acid solutions is being won by the Hastelloys.

This family of alloys plays a major role in the production of Aloyco corrosion-resistan; valves. And here's why:

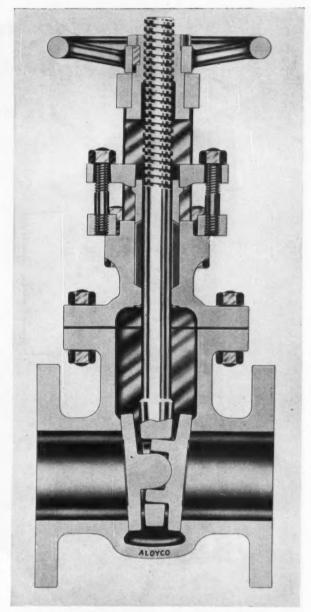
Hostelloy Alloy © is the only available alloy, with the exception of noble metals, that resists hydrochloric acid in all concentrations—even at boiling temperatures. It also withstands corrosion by hot sulfuric acid concentrations where other materials have been found unsatisfactory.

Hostelloy Alloy C at room temperature has good resistance to wet chlorine gas, hypochlorites and other solutions containing chlorine. It is also outstanding for its resistance to secondary spin bath solutions encountered in the rayon industry.

Hastelloy Alloy D has excellent resistance to sulfuric acid at high concentrations and elevated temperatures. It outperforms all other materials in resisting sulfuric acid solutions containing hydrocarbons, coke and tar encountered in oil refineries.

This remarkable Hastelloy family is now available in a wide range of Aloyco valve designs. Cast by induction melting of master heat ingots, Hastelloy valves undergo a special annealing process that imparts better machining qualities . . . assures maximum corrosion resistance. A new bulletin, couponed below, will provide you with complete information.

Write today to: Alloy Steel Products, Inc., Linden, N. J.



Aloyco Hustelloy Valves are suited by composition and a special annealing process to handle hot solutions of mineral acids.



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Name Firm Address_	Bulletin No. 10 on Aloyco Hastelloy valves.

## How to get the right fabrics for clear-flowing filtrates

Maybe filtrate clarity is your problem . . . or the efficient recovery of valuable solids. There's no need to remind you of the hundred-and-one things that can go wrong in a filtration operation. Nor—most of the time—of the reasons why. But isn't it true that many of these production failures could very well be solved by

1) the right type of 2) well-made filter medium 3) correctly installed?

With our century-plus experience in supplying fabrics for industry, this is where we enter the picture.

Whether it's cotton or synthetic...
for whatever type of fabric-using equipment... in any segment of the chemical or processing industries... there's a Wellington Sears fabric in use—or one we can develop—that will solve your problem.

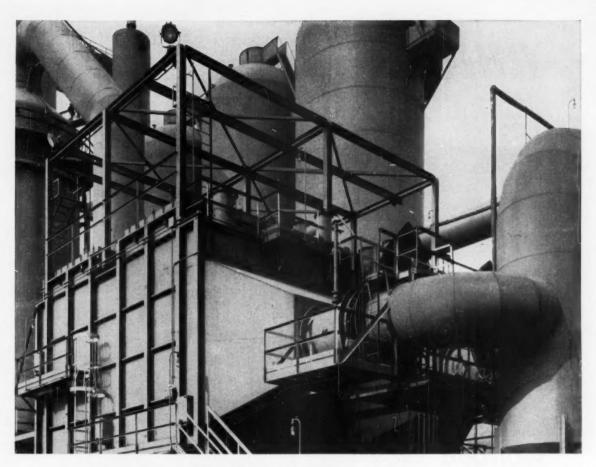
In addition, we offer the services of leading filter cloth specialists throughout the country who distribute our filter fabrics. We will be glad to supply the names of distributors, together with a free copy of "Filter Fabric Facts"—illustrated booklet on filter fabric development and application. Write: Wellington Sears Co., Dept. 1-1

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FIRST In Fabrics For Industry

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Offices în: Atlanta . Beston . Chicago . Dallas . Detroit . Los Angeles . Philadelphia . San Francisco . St. Louis



## **Great Lakes Steel cleans furnace gas with a Koppers Electrostatic Precipitator**

At the Zug Island plant of the Great Lakes Steel Division of National Steel Corporation, blast furnace gas is cleaned and used as fuel for coke ovens, steam boilers, stoves and steel mill furnaces. To clean this gas a Koppers Electrostatic Precipitator was installed.

Actual performance data shows the Koppers Precipitator yields much cleaner gas than specifications called for. In 24-hour operation, it cleans 130,000 cu. ft. of gas per minute; precipitates 3,700 lbs. of solids per 24 hours. Maintenance is minor.

Koppers dependability and performance is attested by the fact that Great Lakes Steel has specified a Koppers Electrostatic Precipitator for another new blast furnace.

Great Lakes Steel's satisfaction and confidence is typical of Koppers installations everywhere. Koppers engineering, research and problem analysis experience have found the solution to hundreds of different gas cleaning problems. If you need assistance with such a problem, call on Koppers—mail coupon below.



### **ELECTROSTATIC PRECIPITATORS**

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • BALTIMORE 3, MD. This Koppers
Division also supplies industry with Fast's Couplings,
American Hammered Industrial Piston and Sealing
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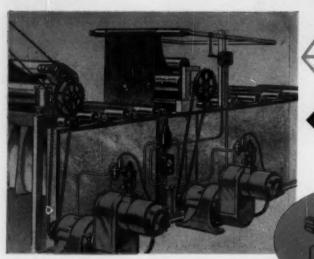
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Gentlemen: I am interested	in a review of my g	as cleaning problem.
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## automation

## in action



### EXAMPLE:

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Speed of "master" Varidrive is set to desired speed of material. The floating or dancer roll in this process maintains a constant tension. Movement of dancer roll signals "slave" Varidrive to produce proper speed for take-up material.

Accomplishing Automatic Control with

VARITROL as a component of

### the U.S. VARIDRIVE

By controlling motor speeds with the Varitrol as a component of the U. S. Varidrive motor, speeds can be automatically changed in response to a signal without human attention for precision-control operations. Above is shown just one of the many ways in which Varitrol automatic control of U. S. Varidrive motors can be used for automatic production control. Varitrol applications obtain efficiency and economy in industrial processes through outstanding savings in processing material, fuel and labor costs.

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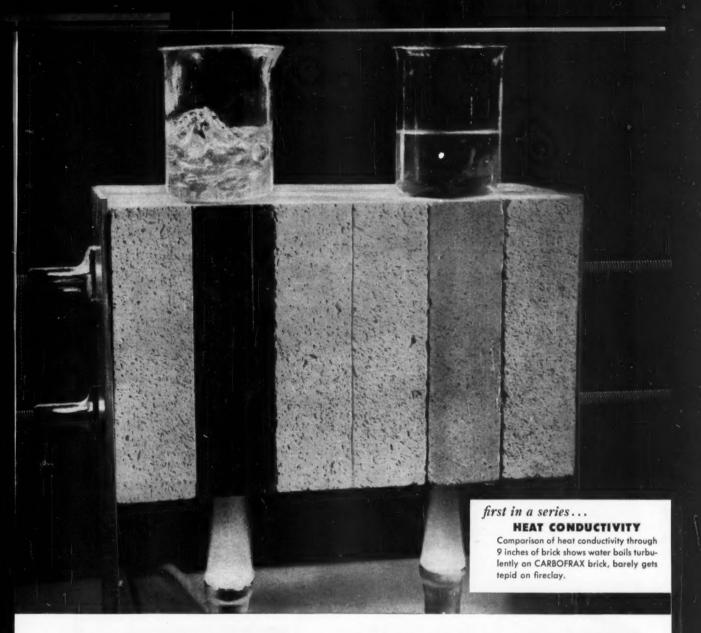
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## U. S. VARIDRIVE

AUTOMATION WITH VARIABLE SPEED



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High heat conductivity — roughly 11 times that of fireclay and about 70% that of chrome-nickel steels — is one of the properties of CARBOFRAX® silicon carbide refractory brick. It is an ideal material for muffles, radiant tubes, retorts and similar structures where you need exceptional resistance to direct flame plus the ability to conduct heat efficiently. At 2200°F, thermal conductivity of CARBOFRAX brick is 109BTU/hr., sq. ft. and °F/in. of thickness.

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Carborundum's new magazine "Refractories" pinpoints many practical applications for these unusual products. The forth-coming issue carries a feature article on "Heat Conductivity". Send for your copy today.

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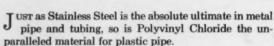
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### is the very best in plastic pipe



National Polyvinyl Chloride Plastic Pipe is not a "substitute" material—it's a high quality unplasticized-rigid pipe, specifically designed for applications where it will do a better job than any other material.

Two types of extruded National Polyvinyl Chloride Plastic Pipe are available in sizes  $\frac{1}{2}$ " to 6" inclusive and in Schedules 40 and 80.

NORMAL-IMPACT—for installations requiring the highest chemical resistance attainable, together with high strength and excellent creep resistance.

HIGH-IMPACT—for installations requiring excellent chemical resistance and a high degree of toughness even at low temperatures. The following properties are shared by both Normal- and High-Impact National Polyvinyl Chloride Plastic Pipe:

Chemical Resistance—resists attack by acids, alkalies, salt solutions, and alcohols, as well as many other types of chemicals. Nontoxic. Will not impart tastes or odors to liquids.

Rigidity -permits use in overhead piping installations with pipe supports. Schedule 80 pipe may be threaded with steel threading dies.

Light Weight—Twenty feet of 2-inch Schedule 40 pipe weighs less than 13 pounds. Easier to install in cramped quarters and hard-to-reach places.

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Ease of Installation-fittings readily attached by either (1) solvent cementing, (2) threading, (3) heat welding, (4) adhesives.

Smooth Internal Surface - results in low flow resistance, minimizes the build-up of deposits.



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For the full story on USS National Polyvinyl Chloride Plastic Pipe, send for Bulletin 24. Write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

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NATIONAL plastic PIPE

UNITED STATES STEEL

### New PAYLOADER

Model HAH

Bucket Capacity — 1cu. yd.
Lifting Capacity — 4,000 lbs.
Carry Capacity — 3,000 lbs.
Breakout Force — 4,500 lbs.
Torque Converter Drive
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Bucket Capacity — 18 cu. ft. Lifting Capacity — 3,000 lbs. Carry Capacity — 2,000 lbs. Breakout Force — 3,000 lbs. Torque Converter Drive



Now, Hough, the pioneer and leader in the tractor-shovel industry, gives you a choice of two new, more productive "PAY-LOADER" units. Both have front-wheel-drive and rear-wheel-steer—especially designed for stockpile work and fast material moving in close quarters. They're the finest of their type in Hough

history — they're both way ahead of the field in design, performance and all-round value.

FEATURES of these outstanding new models include: 40° bucket tip-back at ground; torque converter drive; full-reversing transmissions; closed, pressure-controlled hydraulic system; large hydraulic brakes; accumulator in hydraulic system that prevents pressure shocks and facilitates bucket control; power steer on model HAH.

Your nearby "PAYLOADER" Distributor is eager to show what these new machines can do for you.

Use the coupon below to get full information on any "PAYLOADER" model



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Send data on "PAYLOADER" units	Model HA	Model HAH ☐ larger sizes ☐
Name	Title	Firm
Street	City	State

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Lower your Costs... Simplify Stocks with AO R-2000 Series



Respirators



Accept No Substitutes

Here's top flexibility and cost savings, too, in respiratory protection for the plant with two or more hazards!

FOUR chemical cartridges, THREE re-usable dust filters, and ONE chemically treated throwaway dust filter can all be used in one basic respirator (and quickly interchanged as needed) for protection against a multitude of hazards.

- 1. R-2000 with throwaway all-dust\* filter
- R-2015 with re-usable pneumoconiosis-producing and nuisance dust filter
- 3. R-2016 with re-usable toxic dust\* filter
- 4. R-2017 re-usable all-dust\* filter
- 5. R-2031 with organic vapor chemical cartridge
- 6. R-2032 with acid gases chemical cartridge
- R-2033 with combined organic vapor and acid gases chemical cartridge
- 8. R-2034 with ammonia and alkali vapor cartridge

R-2031 Respirator may also be used for paint spraying with organic vapor cartridge and auxiliary filter. Your nearest AO Safety Products Representative can supply you.

\*dusts not significantly more toxic than lead



†T.M. Reg. by American Optical Company

## "Used many makes of turbines... PREFERS COPPUS"

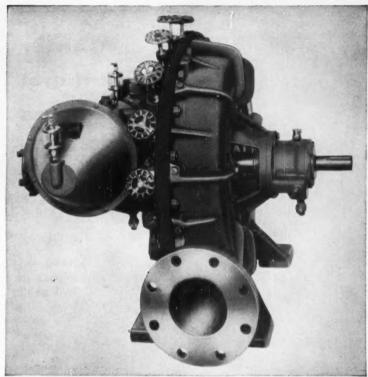
If you want to know about turbine performance, ask an operator. He knows. And, in the words of one of them:

"I have had occasion in the past to operate many makes of turbines. The plant in which I am now employed is almost entirely Coppus equipped on our auxiliary equipment. I find your turbines most satisfactory and would like to congratulate you on your design."

Whether you use a Coppus with a regular wheel or wide bucket "L" type you get these proven features:

- Turbines rated close to your hp requirements from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.
- Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes, make turbine dollars go farther. Send for Bulletin 135 on Coppus Turbine.

COPPUS ENGINEERING CORPORATION 221 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER



This is the reliable Coppus Turbine furnished with either a regular wheel or wide bucket "L" type wheel.

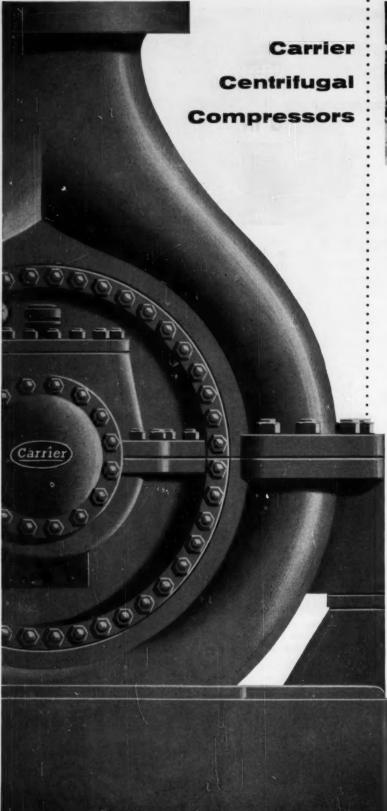


This wide bucket "L" type wheel is a new development for use where low water rate is essential.



This is the regular wheel used on Coppus Turbines which have been so highly satisfactory throughout industry.

COPPUS BLUE TURBINES





on the job at

### Olin Mathieson Chemical Corporation

Two 3000-hp. Carrier Centrifugal Compressors are on the job at the Brandenburg, Kentucky, plant of the Olin Mathieson Chemical Corporation, compressing gas for liquefaction and pumping gas.

Other Carrier Centrifugals are in service at Olin Mathieson plants in Saltville, Va., and McIntosh, Ala,

Carrier makes a complete line of centrifugal and axial flow compressors for gas compression and refrigeration—up to 10,000 hp. in a single unit. There are hundreds of these dependable, efficient Carrier machines on the job at dozens of chemical plants and refineries across the country—Reichhold Chemicals Company, Cities Service Oil Company, Wyandotte Chemicals Corporation, The Texas Company. May we assist you?

If you'd like a copy of our booklet "Centrifugal Compressors for Industry," please call your nearest Carrier office. Or write direct to Carrier Corporation, Syracuse, New York.



centrifugal compressors refrigerating equipment



### HAIR SETTING STORY

Quikupl® fittings used in an alcohol line for the passage of liquid hair spray net have put an end to leaking connections and enabled rapid disassembly for cleaning purposes. If you're looking for a stainless steel fitting which can be put together in a jiffy without welding, threading or flaring, get the facts on Quikupl.

Ask for Bulletin Q100.

### **Pumping Ferric Chloride**

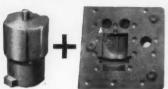
Electronic manufacturers have found the answer to the problem of pumping the ferric chloride needed by their Printed Circuit Departments. The Vanton "flex-i-liner" with Buna N block and Natural Rubber flexible liner is perfect. Since it operates equally well in either direction, a simple reversing switch on the motor provides for quick change in direction of flow.

Catalog VP55 has the facts.

### **THE 75 QUESTIONS**

Valve buyers and users will be glad to know that we've put in a new stock of this popular booklet "75 Questions" which consists of information revealed at Cooper Alloy Valve Clinics. The questions cover materials, operations, service problems, installations and repair of stainless steel valves. They originally appeared as continued bottom col. 2

### CASTING INSTRUMENT HOUSING







Maintaining close dimensional accuracy, fine surface finish and uniform soundness in casting a 11/4 lb. stainless steel instrument housing demanded design conferences with the customer, "tailored" pattern equipment, hand rammed hollow shell cores.

closely controlled pouring range, Shellcast® know-how and special handling from shakeout to shipment. For the full story of how this "impossible" casting is being cast on the production line, ask for Cooper Alloy AKH (Advanced Know-How) Study #3.

### OLE MAN RIVER

When 'ole man river flows through heavily concentrated industrial areas its waters can become extremely corrosive and abrasive, making it highly destructive to pumping equipment. The story of how LeCourtenay design engineers beat the waters of the Monongahela through the use of special materials developed by Cooper Alloy metallurgists, is told in the November issue of Newscast. If you're not on the regular mailing list, a note on your letterhead will bring this issue to you without delay.

75 QUESTIONS continued a feature article in a leading

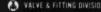
Chemical publication, and are designed for fast reading and easy reference. Copies available on request.

0



The unprecedented demand for our new stainless steel valve and fitting catalog has been welcome but embarrasing. In an attempt to assign each catalog, properly register it, deliver it in person so as to explain the various forms in which it is available and advise our representatives and distributors so that catalogs in the field can be kept up to date, our office staff has been working round the clock and is still falling behind. If you're one of those whose request has gone unanswered, please bear with us. We're doing our best to catch up.





🖒 FOUNDRY PRODUCTS DIVISION 🔞 VALVE & FITTING DIVISION 🎅 VANTON PUMP & EQUIPMENT CORPORATION



Welding 90:10 Cupro-Nickel Head to filter shell of the same material by metallic arc process with 70:30 cupro-nickel electrodes. Iron modified 90:10 cupro-nickel can also be

cold or hot worked, soldered and polished. Containing only 10% nickel, it is more economical yet just as satisfactory as richer alloys in scores of applications.

## A new answer to corrosion and erosion ... iron modified 90:10 cupro-nickel alloy

APPLICATION PERFORMANCE now verifies experimental data showing both the reliability and economy of iron modified 90:10 cupro-nickel alloys.

At a lower cost than richer alloys, the relatively new 90:10 cupro-nickel alloys provide better thermal-conductivity and high resistance to corrosion and other forms of attack . . . particularly to attack from salt or brackish water, such as that encountered by steam plant or vessel heat exchangers, piping systems and condenser tubes.

In addition, the 90:10 cupro-nickel fends off marine fouling organisms and proves advantageous for hull sheathing.

Coming into increased use, because of its high resistance to corrosion and erosion, iron modified 90:10 cupro-nickel is now available from Revere Copper and Brass Incorporated, New York 17, N. Y., in the form of sheet and plate, pipe and tubing.

Whatever your industry, if you have a metal problem, send us details for our suggestions on ways to increase your result/dollar ratio.

Write for . . . List A of available publications. It includes a simple form that makes it easy for you to outline practically any problem for study.



Navy Selected 90:10 Cupro-Nickel for all metal parts in this filter designed to remove every trace of water from aviation gasoline. Heads and shell are of Revere 90:10 cupro-nickel, 1½" thick. Because of this thickness, heads were formed hot at around 1690°F.



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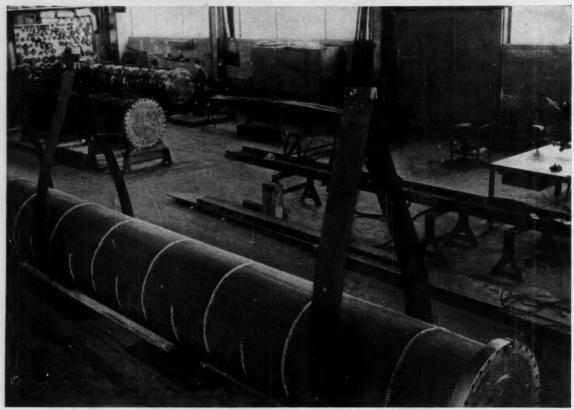
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### From 86F to 112F Below



Tube bundles for huge heat exchangers used in the ammonia synthesis process. The baffles are of yellow brass.

### Ten-ton tube bundle of Anaconda Copper does huge mixture cooling job in Heat Exchangers



Anaconda copper tube being inserted in one of the heat exchangers at the Montreal plant of L'Air Liquide.

### built by L'Air Liquide for ammonia synthesis plants

Straight-tube heat exchangers built recently by L'Air Liquide of Montreal as parts of the equipment separating gases, by low temperatures, for use in ammonia synthesis plants, imposed tough design conditions on materials. Gases enter the warm end at 86F; leave the cold end at -112F. Design pressure on the exchanger is 330 psi. Two of the exchangers are nearly 38 feet long. Each contains over 2000 lengths of 1/2" O.D. x .049" x 35' 4" Anaconda Deoxidized High Phosphorous Copper Tubing — weighing about 20,500 lb. A third exchanger is slightly smaller.

### Anaconda Offers You Technical Service On Condensers And Heat Exchangers

No one tube material serves best under all conditions, but The American Brass Company has worked for many years with manufacturers and users of heat exchange equipment, helping solve many tough process problems.

The American Brass Company maintains special laboratory facilities for this work, keeps records of problems, conditions, findings. This experience and material can go to work for you. There is no charge for this technical service. Talk to your Anaconda representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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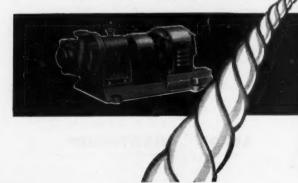
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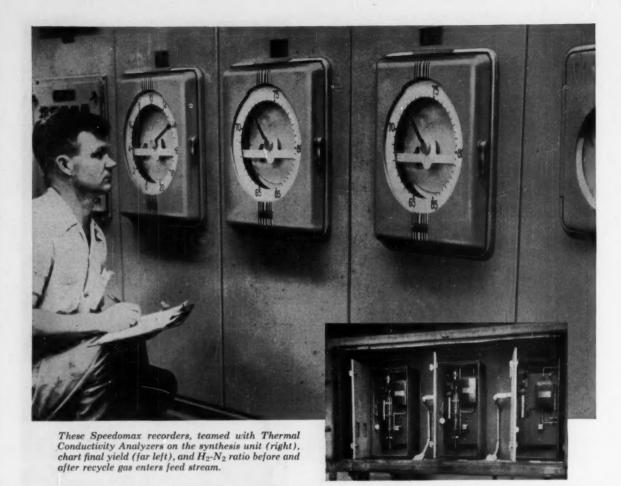
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## L&N Analyzers Help The Atlantic Refining Co. Produce Maximum Ammonia Yield Economically

At The Atlantic Refining Company's modern ammonia plant in Philadelphia, peak performance depends on holding a precise hydrogen-nitrogen ratio to the converter, for maximum ammonia yield. A team of L&N Thermal Conductivity Analyzers with Speedomax® recorders handles the vital measuring jobs involved.

The  $\rm H_2\text{-}N_2$  ratio itself is so important that The Atlantic Refining Company operates two identical L&N Analyzers on the feed stream, one before and one after entry of recycle gas. These continuously record  $\rm H_2$  over a range of 65 to 85% while another Analyzer, calibrated 0 to 20% NH<sub>8</sub>, records ammonia yield from the converter, and the amount returned in the recycled gas stream.

Feed hydrogen for the process is a by-product of The Atlantic Refining Company's design of catalytic reformer, known throughout the industry as a Catformer.

The Atlantic Refining Company's applications are typical of hundreds of successful jobs these recording and controlling L&N Analyzers are doing, not only in other ammonia synthesis plants, but on widely varied measurements throughout the process industries. For complete product data, write for Folder ND46-91(2). Or, to find how analytical control can benefit specific processes you have in mind, outline your problem for our engineers without obligation. Our address—Leeds & Northrup Co., 4916 Stenton Ave., Phila. 44, Pa.



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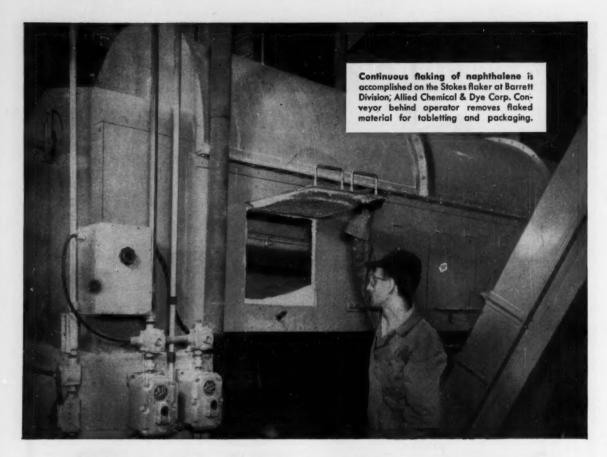






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## Barrett improves quality, cuts costs in naphthalene production



Purity is higher, costs lower with continuous flaking process. Flaked naphthalene is compressed into balls or rings, with the aid of Stokes tabletting machines.

### Stokes flaker replaces batch method in the processing of moth-killing chemical

Marketed in flakes, balls and handy rings which slip over the hook of coat-hangers, naphthalene is the housewife's friend—and the moth's worst enemy.

At the Barrett Division of Allied Chemical & Dye Corp., molten naphthalene at 194°F. is fed to a Stokes single drum flaker where the material crystallizes on the revolving drum. The solidified naphthalene is removed by a doctor blade at 72°F. in quantities ranging up to 1500 pounds per hour. Subsequent tabletting operations on Stokes tablet machines produce finished moth balls and rings.

Before purchasing the flaker, Barrett called on the Stokes Advisory Service and Laboratory for recommendations. Tests in the Stokes Laboratory determined the appropriate drum temper-

ature, rotating speed and size of the unit required to give desired production. Similar tests have preceded the design of flakers for wax, insecticides, resins, many chemical intermediates and other products suited for high capacity flaking.

Stokes makes its broad experience in all phases of chemical processing available to manufacturers through this well-staffed Laboratory and Advisory Service. Full details of this laboratory and advisory service for the solution of production problems are covered in Bulletin 640.

Send for this booklet as well as an informative brochure on Stokes equipment for the Chemical & Processing Industries. F. J. Stokes Machine Company, Philadelphia 20, Pa.

STOKES

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because both QCf Regular Round and QCf Rectangular Port Valves have port areas at least equal to the pipe itself. Result: no turbulence to flow of viscous ladings and no restrictions to cause abrasion... no loss of head pressure... all highly desirable features throughout the processing industries.

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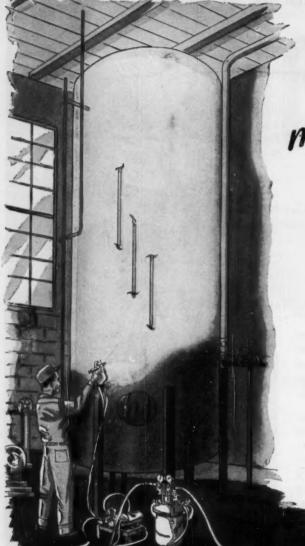
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\*BUPONT TRADE NAME

QCf PLUC VALVES



HERE ARE COMPANION PRODUCTS TO MAKE YOUR FIGHT AGAINST CORROSION...



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But cost savings are, in a sense, the least important part of the story. You get better protection, more complete protection, longer lasting protection from corrosive attack.

> \* ADHESION THICKNESS DENSITY

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### JANUARY 1956 · Chementator

H. T. SHARP

### ✓ Scientific Design Co. has a new and unique chloride volatalization process for lithium and lithium chemicals from pegmatite. It's now negotiating with likely prospects.

- Via a new process, Monsanto is starting its first aliphatic amine production—tert-butylamine at Texas City. And possibly presaging another first for Monsanto is its keen interest in a potash well now being drilled in Utah.
- Food Machinery and Chemical and Wisconsin Alumni Research Foundation have bared details of their nitric acid by nitrogen fixation process. An FMC-WARF-sponsored symposium told industrialists how a commercial trial made tonnage high grade acid, but that costs were too far out of line. Now FMC, while continuing its own work, wants industry's ideas on cost-cutting.

### Help coming for isocyanates makers

One of the big questions facing the budding isocyanates-polyurethanes industry is what's the best way to get required phosgene. Because for the first time big volumes of this chemical will be demanded by private industry.

Many feel it's impractical to ship large amounts of phosgene around the country. In fact, when Hooker Electrochemical no longer needed if for its own operations several years ago, it decided to quit being a supplier to other firms.

General Aniline, which does not now make isocyanates, but needs phosgene for certain dyestuff intermediates, hopes it has a good solution to the problem in a new reactor (patents applied for) that yields pure carbon monoxide. Reaction of CO with chlorine gives phosgene (COC1<sub>2</sub>). Because of its simplicity, the GAF generator could be used by both big and little users of phosgene. Thus any company could get into isocyanates on any scale.

GAF will now extensively test the reactor—a modified electric furnace fabricated by Pittsburgh Lectromelt Furnace Co. Carbon dioxide passes up a bed of hot petroleum coke, heated by two stationary electrodes. Depending on the temperature, almost any purity CO can be withdrawn from the top of the reactor.

Other proposed processes for making phosgene involve reforming hydrocarbons, removing  $\mathrm{CO}_2$  with ethanolamine, low-temperature separation of  $\mathrm{CO}$ , with caustic scrubbing for purification. Then the pure  $\mathrm{CO}$  is reacted with chlorine to phosgene.

### Mixed fertilizers direct from rock

It's not definite yet, but chances are very good that contracts will soon be signed that will mean a commercial tryout for a new complex fertilizer process owned by Cannac Research and Development, New York. What's exciting interest is that the technique, which starts by treating phosphate rock with nitric acid, yields a high-analysis, essentially fluo-

rine-free product with very low hygroscopicity.

Joseph Abeles, vice president of Cannac, says the process can be licensed through Blaw Knox, but can't now reveal what companies are evincing interest. There's also a possibility that Cannac, or an allied firm, Nitrophosphates, Inc., may build a plant of its own on a recently purchased site near Lemont, Ill.

Simply, the patented process (U. S. 2,683,075) is this: Nitric acid (30-45%) dissolves phosphate rock in a tank. Resultant calcium nitrate-phosphoric acid is filtered or centrifuged to drop out all acid-insolubles. To remove fluorine, which would cause reversion of the final tricalcium phosphate to its original insoluble form, potassium chloride is then added to the liquor in a second tank. This precipitates potassium silicofluoride, which is recovered by filtration.

While filtrate is vigorously agitated by a propeller-type agitator, anhydrous ammonia is added through a sparger pipe. Terminal pH of 7 is optimum; similar processes hold pH at about 4.5 because fluorine is present.

A mixed fertilizer (e.g., 14-14-14) precipitates and is dried in a rotary dryer at about 250 F. Since all calcium ion is combined with phosphorous (as tricalcium phosphate), there's no calcium nitrate in the final product, so water pickup and caking are minimized.

The phosphate portion of the final product is completely citrate-soluble. Removal of fluorine is economically justified because enough potassium silicofluoride is recovered for sale to the ceramic and foam rubber industries—price is about 10¢/lb.—to pay for recovery.

### New N15 process slashes nuclear costs

By devising a way to produce cheap, concentrated nitrogen 15, AEC-supported Columbia University researchers may have opened the way to wider use of economical thorium-type breeder reactors. Their process is important, too, in that N<sup>15</sup> is a valuable tracer in studying use of nitrogen fertilizers by plants, formation of protein by animals and various photosynthesis reactions.

One hitch in the development of the thorium-type breeder reactors has been the attraction ordinary nitrogen (N<sup>14</sup>) has for neutrons. N<sup>15</sup>, on the other hand, lets neutrons pass through to nonfissionable thorium 232 (present as thorium nitrate) and convert it to the fissionable fuel uranium 233.

Unfortunately, in nature there are only

3.8 parts of N<sup>15</sup> in every 1,000 parts of ordinary nitrogen. And until now the highest concentration of N<sup>15</sup> available in quantity has been 60%—at \$175,000/lb. But with the new method, 95% N<sup>15</sup> can be made commercially at about \$500/lb.

The Columbia process passes nitric acid through several cascade-arranged columns packed with stainless steel helices. In the last one, sulfur dioxide gas enters and reacts, as in the lead chamber process, to form liquid sulfuric acid and nitric oxide gas.

Sulfuric leaves the column at the bottom while the gas moves up countercurrent to the nitric acid. In a series of exchange reactions involving 250 stages, the N<sup>15</sup> in the gas transfers to the acid and a stream of N<sup>15</sup>-rich acid is taken off just above the SO<sub>2</sub> inlet.

Large-scale operational plans haven't been laid yet, but while researchers study effects of temperature and pressure on exchange rates, AEC engineers are discussing ways to:

- Remove the high reaction heat.
- Keep N<sup>15</sup> in the byproduct acid below 5 ppm.
- Handle the huge volume required. A 50-lb./day plant would use 1,200 tons/day of SO<sub>2</sub> and (sulfuric acid makers note) turn out 2,000 ton/day of saleable 55° Be sulfuric.

### The polyethylene story (cont'd.)

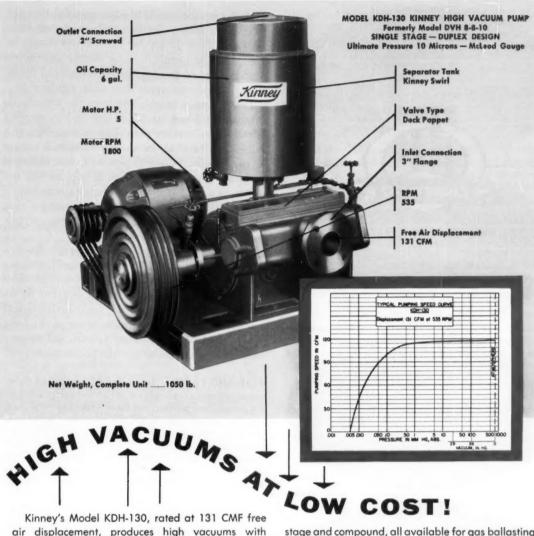
The rush to make polyethylene keeps gaining momentum. Latest to join the raft of producers and potential producers is a 50 million lb./yr. unit to be built on the West Coast. And anticipating the good possibility that one or more plants will be built in the Midwest, both Ashland Oil and Standard Oil of Ohio are considering building ethylene plants there.

The West Coast unit is a joint venture of Brea Chemicals and Koppers and will use the near-room-pressure Ziegler process. It will likely be built at Union Oil's (Brea's parent) San Francisco refinery with Union's hypersorption process used to purify the ethylene.

Ziegler polyethylene also made news in Germany. At a meeting in Munich, Dr. Ziegler revealed that his now-famed process was discovered through one of those fortunate errors which stud the history of chemistry.

Ziegler studied reactions of lithium hydrides in the 1940's, found lithium ethylate polymerized ethelene to a wax-like solid and that alu-

(Continued on page 108)



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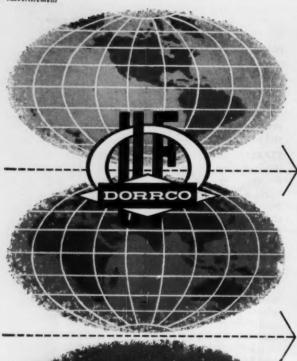
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1955 has been a year of change, consolidation and progress in both a corporate and a technical sense for Dorr-Oliver. Just a year ago we were deeply involved in the complexities of merger and, as we near the end of this first year of combined operations, a review has more than usual significance.

Perhaps most notable has been the remarkable integration of our combined staff and its growing effectiveness in every area of operation. With this integration came important organizational change — the creation of new groups to handle technical problems more effectively and to explore new opportunities. With it also has come the strengthening of sales staff in some areas and the opening of new offices in others, designed to provide better service to our clients and customers.

Of the utmost importance in this rapidly developing picture is the welcoming of Dorr-Oliver-Long Limited as a full member of the worldwide D-O family. The natural result of a close and friendly relationship dating back to 1911, the consolidation of our Canadian operations with those of E. Long Limited of Orillia on January 1, 1956, will unquestionably strengthen our overall operations.

PULP AND PAPER — In 1955, field testing and subsequent commercial acceptance of the Webwelder for splicing corrugating medium and other heavy grades of paper was among our most significant projects. Contributing heavily to our volume of business were new or expanded Recausticizing Systems in the Pacific Northwest, Southeast, Canada, India, Sweden, Finland, Mexico and Chile. Next year the Horizontal Filter, already used for washing cotton linters, will be applied to pulp washing in a Southern mill.

INDUSTRIAL WASTES — Also in the pulp and paper industry, the largest biological kraft mill waste treatment plant in the world went into operation at West Virginia Pulp and Paper Company's Covington, Virginia, mill. And on the West Coast the most comprehensive treatment plant ever designed is now on stream handling wastes from an oil refinery. Both are D-O equipped. Orders were placed for waste treatment units to serve a midwest cannery and a large Eastern photographic equipment manufacturer.

**PETROLEUM** — The newly introduced D-Sander has proved to be extremely successful in removing sand from rotary drilling mud and has been widely utilized in the Gulf Coast oil fields. Fabrication of the longest petroleum filters ever constructed — six 10' x 22'3" Olivers for dewaxing — was completed at our Hazleton shops. Research and development continued on a new and unusual type of hydrocarbon purification unit, the applications of which appear almost boundless in the petroleum industry.

**URANIUM** — During the year a large D-O equipped Canadian uranium mill went into operation and orders were received for processing equipment to be used at six other United States and Canadian mills now under

construction or being expanded. Facilities at our Westport laboratories have been enlarged to handle all types of uranium extraction work and to process small quantities of material from ore through "yellow cake". In a closely related project — the production of rare earths — D-O equipment will be widely utilized in a plant under construction.

SUGAR — As a result of three years of development we have introduced the RapiDorr Cane Juice Clarifier designed with 30% less volume than conventional units. A number of these machines will be in operation in the coming 1956 campaigns. Our associates in Italy have sold two Continuous Carbonation Systems for beet sugar processing on the Italian peninsula and mills in India will clarify cane juice in units manufactured by D-O GmbH in Wiesbaden.

**SANITATION** — On the new Ohio Turnpike, wastes from eight service areas will be treated in D-O equipped plants. On a much larger scale, London, England will utilize sixteen Dorr Digesters in the expansion of their treatment facilities and in India two new sewage plants will be completely D-O equipped. At Milwaukee, Wisconsin, four sewage sludge filters will replace the original Olivers installed some 33 years ago and next year at Baltimore, Maryland the largest sanitary filters ever constructed — two 14′ x 18′ units — will go into operation.

The Densludge Process of prethickening sludge is now operating at two full-scale Biofiltration plants in the Southwest with general improvement in overall plant performance an unexpected result of its use. Tests have been virtually completed on a new Degritting Clarifier to be placed on the market in the near future. The Refuse Treator, which was developed in Holland and which may soon become an integral part of the domestic D-O line, gives the sanitary engineer another tool for the accomplishment of his ultimate goal.

**RESEARCH AND DEVELOPMENT** — Fundamental research has continued on the unit operations basic to D-O equipment. While such work is necessarily of a long range nature, increased fundamental knowledge has already led to marked advances in the field of clarification.

In addition to improvement of basic units, the company is constantly investigating new lines which can be profitably integrated with our other business. Current projects include an investigation to determine the manner in which D-O can make further contributions to the Atomic Energy Program and development of an ingenious Dutch device for fine screening.

**COPPER** — Half a world apart — in Israel and Arizona — two D-O designed copper ore dressing plants, one a full-scale operation and the other a pilot plant, are now under construction. In the United States, three large concentrators in the Southwest ordered equipment for plant expansions and in the Belgian Congo the first FluoSolids System to roast copper concentrates prior to electrolytic recovery went into operation.

FERTILIZER — Missouri Farmers Association's new plant, proving ground for the Diammonium Phosphate Process, attained design capacity in record time at Joplin, Missouri. Utilization of this new process makes commercial production of unusually high analysis fertilizer from concentrated phosphoric acid possible for the first time. In

Japan, two more D-O designed fertilizer plants went into operation and a third was under construction in Norway.

**WATER TREATMENT** — In the field of water purification, Caracas, Venezuela and Kansas City, Missouri have duplicated orders of previous years for plant expansions and new facilities now under construction in both India and Turkey will employ extensive D-O equipment. First installations of the PeriFilter System, introduced two years ago, have shown marked economies of construction and unusual adaptability to small plants.

STARCH — Following the example of current practice in the Netherlands where the DorrClone was developed, five starch processing companies in other parts of the world ordered DorrClone Systems for their operations. Starch Washing Systems — each the first of its type in the various countries — will be installed in Brazil, Canada, Scotland and the United States. A fifth producer will use TM DorrClones to recover solids from starch washing filtrate in the U. S.

FLUOSOLIDS — Most significant achievement in the field of fluidization was the successful commercial demonstration of the first FluoSolids Coal Dryer. Equally adaptable to the drying of either metallurgical or steam coal, this unit will handle material as coarse as 1½" with ease. During the year two other "firsts" were recorded — the first FluoSolids System went into operation in the Philippines and the first purchased for use in Germany. Repeat orders were received from companies in South Africa, Canada, Italy and Japan, and in the U. S. a large copper producer ordered its fourth complete System and seventh individual Reactor.

CHEMICAL — Expansion plans for alumina processing facilities in Jamaica and Germany, a potash countercurrent decantation system in New Mexico, and new brine purification and pigment plants in the U. S. all incorporated substantial amounts of Dorr-Oliver equipment in their flowsheets.

Any pride we may feel in the events and accomplishments of the year is shadowed by the sudden passing of one of our Founder-Chairmen, Edwin Letts Oliver, late in the summer just past. His mechanical genius, strength and human warmth will be deeply missed by the engineering fraternity of the world. To Dorr-Oliver, and to those of us who knew him well, his loss is irreparable.

For the future, our resources are considerable. The initial enthusiasm and resourcefulness of our staff, the promise of new developments and the strength and solidarity of our Associates in Canada and abroad — all point to a steadily increasing ability to serve and an eventful year ahead.

BAILE J.

Stamford, Conn., U.S.A.

minum acylates worked even better. The experiments were dropped, however, until shortly after Imperial Chemical Industries commercialized its high pressure polymerization process in England. Then Ziegler took up his old experiments, and a student's error in using an uncleaned autoclave gave them a big, and unexpected, boost.

Tiny traces of colloidal nickel in the autoclave catalyzed a reaction which made pure butadiene. Other metal catalysts and cocatalysts were tried, with a combination of aluminum triethylate and titanium tetrachloride doing the best polymerization job.

In the process finally developed, these catalysts are suspended in an aliphatic oil and ethylene passed in. Heat is evolved—the temperature climbs rapidly to 120-160 F.—and cooling is needed. After an alcohol wash the polyethylene is filtered and dried.

### New process gives pure peroxide

Continuous fractional crystallization is the key to a newly revealed process for making extremely pure, very concentrated hydrogen peroxide. Developed by the Becco Chemical Div. of Food Machinery and Chemical, the process makes  $\rm H_2O_2$  of over 99.6% purity commercially practical for the first time.

Introduction of 90%  $H_2O_2$  in 1946 opened a wide number of new uses for peroxide, including rocket propulsion. The new process is expected to have a similar effect since the purer product has both higher internal energy and greater bleaching strength.

Becco concentrates its peroxide to about 90% by fractional distillation. This is the optimum feed stock concentration for the crystallization operation. While details haven't been unveiled as yet, a newly issued patent (U.S. 2,724,640) says that Becco moves solid  $\rm H_2O_2$  countercurrent to liquid  $\rm H_2O_2$  in the crystallizer. In an exchange action the impurities move from the solid phase to the liquid. Peroxide concentration can be regulated by adjusting the take-off point.

### Liquid gas barging plans now set

A scheme for liquefying hydrocarbon gases at the well head, barging them to distant areas (vaporizing part of the liquid for fuel), putting the cold liquid to work as a refrigerant as it vaporizes and finally using the vapor as chemical raw material or fuel is

getting \$80 million worth of backing by a well-heeled industrial syndicate.

As originally conceived, the project involved liquefying methane (to —258 F.) in Louisiana by expanding the gas, already under 2,800 psi., through a special turbine. It was to be shipped up the Mississippi in balsa-insulated barges using methane vapor as barge fuel. At Chicago it was to be used as a refrigerant by the stockyards and, after it was all vaporized, sold to Midwest chemical or oil firms or as fuel.

However, since the scheme's inventor, Chicago inventor Willard Morrison, sold out to Continental Oil, the project has taken on global dimensions. A new syndicate that includes Continental, Koppers and Westinghouse has decided it would be cheaper to liquefy butane and propane (to some —50F.) and that Middle East-to-Europe shipping is more profitable.

Main reason is that raw materials and shipping cost less this way. About 500 mcf. of natural gas are now flared daily in the Middle East. The syndicate will ship about 300 mcf. to West Germany and use another 100 mcf. to make ammonia—also for West Germany. Shipping costs are lower with butane and propane than with methane because less refrigeration and insulation are needed.

Though barges for the earlier venture were reported nearing completion, tankers to be built and operated by Greek shipping magnate Aristotle Socrates Onassis are expected to be used in present plans.

### Chemical processes to aid steelmakers

Faced with a demand so high that many producers are running at over 100% of their rated capacity, steelmakers are turning to auxiliary chemical processes to wring still more production from their present facilities.

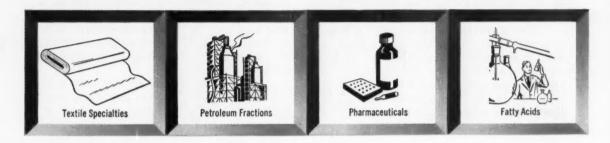
Seven top steel firms and plant-builder Blaw-Knox are teaming up to develop a pickle liquor recovery process which ends a waste problem and also promises to boost production in the pickling stage. Tabbed the Ruthner process, it was devised in Europe about 5 yr. ago and has been used in a few small plants there.

Design of a pilot plant has started and it's expected to start up in the fall at Niles, Ohio, site of a Republic Steel plant. The whole development program will cost some \$400,000.

The process partly evaporates the pickle

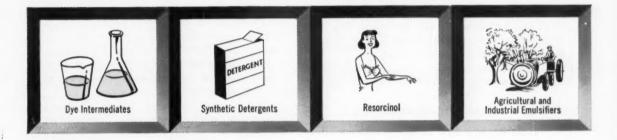
(Continued on page 110)

#### SULFONATIONS FOR SULFATIONS



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SULFAN is used for sulfonation, the waste acid problem inherent with sulfuric acid or oleum is also eliminated.

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will be held in strict confidence.

**Product Development Department** 

#### GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

Basic Chemicals for American Industry

Illied hemical liquor, then chlorinates the concentrate with HCl gas. The ferris chloride and sulfuric acid slurry that results is centrifuged and the H<sub>2</sub>SO<sub>4</sub> degassed and reused. FeCl<sub>2</sub> is roasted to recover HCl gas and FeO which goes back to the mill, thus giving total recovery of the waste pickle liquor.

More important to order-harried steelmen, however, is the higher throughput which results in the pickling room. Since the liquor is no longer a waste to be neutralized and disposed of, the pickle acid can be more concentrated and so do its job faster. And a more concentrated liquor cuts the load on the evaporators and makes the Ruthner process more economical.

To speed up the process in open hearth furnaces, two companies, Jones & Laughlin and Wheeling Steel, plan to join McLouth Steel in using an Austrian-developed oxygen converter process in place of the universally used Bessemer converters. By forcing oxygen (99.5% pure or better) in at the top of the open hearth instead of blowing ordinary air in at the bottom as in the Bessemer, this is expected to boost capacity about 15% at Jones & Laughlin's Aliquippa, Pa., plant.

This higher capacity cuts unit costs far enough to absorb the \$5-10/ton oxygen costs.

#### Taking a different route to lithium

With its new \$6.6 million plant now onstream at San Antonio, Tex., American Lithium Chemicals (an American Potash & Chemical subsidiary) joins Foote Mineral, Lithium Corp., Maywood Chemical and Ampot as major competitors in the race for the lithium dollar.

ALC is starting with different raw materials than other producers, shipping lepidolite ore in from Africa. But its process closely resembles that used by Foote (Chem. Eng., Dec. 1955, p. 113). The only significant differences between the two stem from the differences in starting materials.

At San Antonio, ALC feeds one part lepidolite and three parts Texas limestone to a ball mill for wet milling to about 200 mesh. The slurry is thickened, then sintered in a 12 ft. x 325 ft. rotary kiln at about 1,560 F.—somewhat cooler than Foote operates. Retention time is about 4 hr.

Quick quenching in strong liquor from the countercurrent leaching system follows to keep the lithia soluble and thwart phase changes in the lithia, alumina, silica and alkali complex. These alkalis carry through to the leaching step and prevent ALC's going straight to lithium hydroxide monohydrate as Foote does.

ALC uses two three-tank lines in parallel, at 210 F., followed by two tanks at 140 F. in series, to leach out lithium values. Leach products then pass through counter-current wash thickeners. Gangue from these goes to rotary filters, and lithium-containing liquor passes to jet filters for cleanup.

Clear liquor is concentrated and most LiOH crystallized in a triple effect evaporator, with the effects held at 250, 200 and 140 F. The crude LiOH crystals are recrystallized and packaged. Any lithium left in the liquor is recovered by carbonization.

#### Get more oil out of the ground

One way to beef up our vital oil reserves is to find better methods for recovering the highly viscous oil that defies normal drilling operations. Forcing it out with steam or water under pressure doesn't always work and industry is having to try more radical techniques. Even the possibility of lowering this oil's viscosity by pumping liquid metal coolant from nuclear reactors through heat exchangers at well bottoms is not being overlooked.

But of more immediate interest is a new underground combustion method developed by Worthington Corp., Harrison, N. J., working with Forest Oil of Bradford, Pa. Two years of successful tests indicate that it can add several billion barrels of now-unrecoverable oil to our proved recoverable reserves. And Worthington is now designing a large semi-portable thermal oil production plant.

Available details are skimpy (while patent action is pending), but the company does say its technique differs considerably from other thermo-combustion methods.

Both hot air and steam are used to free the entrapped viscous oil. The air heats the oil by burning part of it, and steam and hot combustion gases drive the warmer, freerflowing oil to the surface. In the test area, 80% of previously unobtainable oil was directly recovered, about 10% was burned, and the final 10% driven to an adjacent field for later recovery.

Best profits from the new technique will be from operations covering over 100 acres.

#### For more of WHAT'S HAPPENING . . . 114

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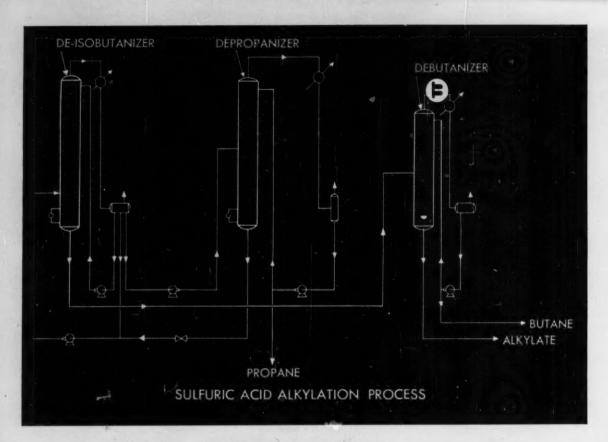


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Cut isobutane loss in debutanizer overhead...

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cated automatic standardization. They provide the best zero and range stability available.

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January 1956—CHEMICAL ENGINEERING

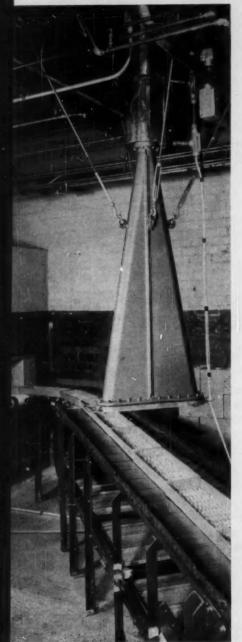
## What's Happening

#### JANUARY 1956 FEATURE NEWS

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### **Atom Smasher: New Process Tool**

Bradley Containers' electron accelerator sterilizes pharmaceuticals and irradiates polyethylene on a continuous, economical basis.



ELECTRONS STERILIZE drugs as they move under beam disperser.

TUCKED into the northeast corner of Massachusetts is a young and forward-looking company that's helping set the pace for commercial application of radiation to chemical processing.

At its plant at Maynard, Bradley Container Corp. is using a 2-mev. Van de Graaff particle accelerator to sterilize pharmaceutical packages, either filled or empty, and to irradiate injection-molded, mass produced polyethylene items. Bradley stakes a claim as industrial pacesetter on these two firsts:

• First electron-beam sterilizer used in commercial packaging.

 First commercial installation for irradiation and sterilization of mass-produced items.

To High Voltage Engineering Corp., Bradley's program marks a significant milestone for its Van de Graaff accelerator. Formerly the Van de Graaff (as well as other accelerators) had been restricted to medical therapy and investigation, to basic physics research and to radiography (Xray inspection) of metals.

► Busy Years—The past two years have been busy ones for machine-produced radiation:

• In the summer of 1954 General Electric announced production of an irradiated polyethylene insulating tape. Electron bombardment of polyethylene produced cross-linkages which upped useful operating temperatures.

• In October 1954 Bradley began sterilizing empty pharmaceutical packages, later extended treatment to packaged opthalmic ointment. Six months ago the company began irradiating portions of polyethylene inkbarrels to toughen them and prevent their cracking during assembly of ball-point pens.

 This past fall Upjohn, veteran drug manufacturer and long a worker in radiation sterilization, announced it was offering for sale a radiation-sterilized drug (via a Van de Graaff electron accelerator).

 Clay Adams Co., New York manufacturer of medical and surgical equipment and supplies, recently began sterilizing surgical tubing via irradiation by a Van de Graaff.

• A manufacturer of polyethylene equipment is irradiating the plastic to withstand high temperatures.

Just as busy, although in a more private and exploratory manner, are these chemical and petroleum companies: Dow, Du Pont, Bakelite, Carbide and Carbon, Humble, Atlantic Refining, Gulf, Esso, Shell, Magnolia. The chemical outfits are really playing it close to the vest, won't even tell the accelerator manufacturers what they're doing. The oil people will at least admit to irradiating petroleum products to determine if they can be altered for the better; to looking for ways to effect petrochemical processes via radiation; or to using radiation to detect otherwise undetectable petroleum re-

▶ How Bradley Does It—Bradley Container extrudes and fabricates all sorts of polyethylene containers for virtually any material packageable in polyethylene, also does the filling and sealing. Last report: Two million tubes and bottles a week. It's the sterilization of such containers, though, that makes our story.

Polyethylene containers—tubes, squeeze bottles, etc.—ride a conveyor belt into a shielded area and under the electron accelerator. A powerful beam of electrons quickly and effectively destroys all bacteria inside and outside the containers without harming either the polyethylene or the drugs which may be contained therein. Sterilized empties are packed in sealed bags and sent to the drug maker, who fills

them under aspetic conditions.

The unit at the Maynard plant can sterilize small filled containers, inside and out, within certain dimensional limits, the most critical of which is depth. Radiation from the 2-mev. Van de Graaff generator penetrates about ½ in. of material with a specific gravity of 1.0; a 4-mev. unit will pierce about 1 in. Bradley's first over-all sterilization job was on a 10-mm.-dia. tube of opthalmic solution, specific gravity of 1.0.

Processing rate: 3,000-15,000 unfilled packages per hr., depending on size (they range from 1 to 8 oz.) and 5,000-8,000 filled pieces, or about 5,000-8,000 cc.

per hr. of drugs.

Bradley has sterilized containers and/or drugs for Rexall, Sharpe, & Dohme, Ciba, Schering, Lilly, and Parke, Davis.

▶ Poly Irradiation, Too—Not content with its success in radiation sterilization, Bradley is emphasizing polyethylene irradiation as well. One of the reasons: Contracts with two large manufacturers for irradiation of small parts of injection-molded articles. These items necessarily must be toughened in just one place to permit assembly. The other reason: There's less scrutiny and responsibility attached to plastic treatment.

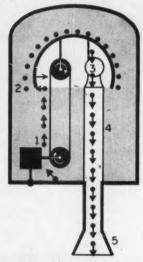
About Sterilization Methods— Bradley prefers radiation sterilization to other sterilization methods, such as steaming, ethylene oxide treatment, ultraviolet light treatment and filtration.

Here's why:

Filtration can be cumbersome and messy. Ethylene oxide can be troublesome; it is a toxic gas and may also combine chemically with the material being sterilized. Steaming may harm or destroy the material and requires intermittent operation in vessels. Ultraviolet light treatment is slow and effective only for a very low degree of penetration.

Although admittedly more costly at the outset than any of these methods, electron sterilization can make these claims:

 Sterilization of a product can be done in the final, sealed package without damage to the container and without possibility



#### What You Should Know About Accelerators

Electron accelerators may or may not be for you. But one thing's sure: You can't afford not to know something about them.

▶ What Are They?—Machines for producing a high-intensity, high-speed beam of electrons. The beam is accelerated from a very high voltage to ground (as in direct-beam machnes like the Van de Graaff, above) or by successive local fields generating waves of radar-frequency energy (as in the new, higher-penetrating indirect microwave linear accelerator).

Penetrating Power-Directly proportional to the energy in mev. (million electron volts) of the beam and inversely proportional to the density of the material beng irradiated. A 1-mev. machine pierces 0.20 in. of water-equivalent material. Double bombardment-treatment from both sides-gives more than twice the penetration. Direct units are limited by economics to about 4 mev., but the new linear accelerator can be built for 12 mev. and higher, can penetrate much deeper than present direct units. ▶ What Can They Handle?—Directbeam accelerators effectively treat:

• Films (cross-linking polyethylene tape, sheets, small tubes).

Gas-phase chemical reactions.
Liquid-phase chemical reactions

Electric charge is sprayed onto a fast moving belt (1). The belt carries the charge to an insulated terminal (2), setting up a high potential with respect to the lower end of the accelerator. Charged particles then jump from a heated cathode as electrons (3) and flee through an evacuated tube (4), their only path of escape from the high-voltage terminal. Scanning coils (5) disperse the beam of electrons for greater efficiency.

where small-diameter tubes can be used.

• Solids up to 11 in. thick (density of 1.0) with double bombardment; this includes most molded polyethylene items.

• Liquids and powders up to 1 in. thick (density of 1.0) with single hombardment.

► What Do They Cost?—Here are typical costs (without accessories):

Machine Rating	Capital Cost	Coet/Kw
Van de Graaff		
1 mev./0.25 kw.	\$35,000	\$140,00
2 mev./0,50 kw.	60,000	120,000
3 mev./3 kw.	114,000	38,000
3 mev./12 kw.	400,000	33,000
Linear accelerators		
5 mev./4 kw.	165,000	41,000
10 mev./3.5 kw.	190,000	54,00

Volume production should reduce future costs of both types to \$20,-000/kw, or less.

DOV/KW. OF less.

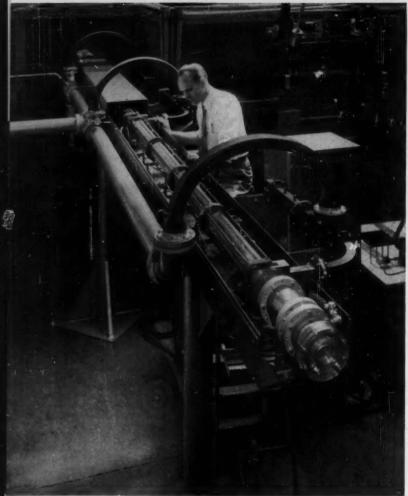
Departing Costs—For a 3-kw. machine, assuming five-year amortization and 4,000 hr./yr.: \$9/operating hour (\$6 for amortization, \$2 for maintenance, \$1 for power) or \$3/kwh. But look for electron power to be less than \$1/kwh. in a counle of years.

If you operate an accelerator at full capacity on a full-time basis, complete sterilization will cost about 1¢/lb., plastic film and sheet can be improved for 6¢/lb., and suitable chemical reactions can be carried out for 0.33¢/kcal.

► Machine vs. Nuclear — Machine radiation is here today. Most talk about nuclear radiation has to be speculative because it concerns future availability of radioactive materials, future performance and future costs. Nuclear radiation will come, of course, but, as machine radiation boosters put it, "not until late tomorrow."

#### Processing Capacity-A 1-kw. electron beam can treat (lb./hr.):

	Irregular Solida	Rectangular Solids	Films, Fibers, Fluids, Some
	(Single	(Double	Chemical
	Bombardment)	Bombardment)	Reactions
Complete sterilization of food and drugs	240	330	400
Polyethylene crosslinking	24	83	40



LINEAR ACCELERATORS penetrate deeper, open new processing vistas.

of recontamination prior to use.

 Packaged or bulk material to be sterilized can be conveyed in an uninterrupted flow beneath the electron beam. This is in contrast to normal batch sterilization processing.

 With a properly regulated unit complete sterility can be reproducibly assured in each product unit. Radiation sterilization is the only method whose effect is virtually instantaneous.

Summing up the virtues of particle accelerator as a means of effecting sterilization via radiation: It is safe, is not dependent on critical materials, can be installed anywhere electric power is available and does a clean, fast job of guaranteed sterilization.

In short, today electric-powered machines look best for economical chemical processing via radiation.

#### New Process and Plant In Huge Borax Expansion

An \$18 million expansion of Pacific Coast Borax Co.'s facilities at Boron, Calif., encompasses a changeover in mining methods and new plants for borax concentrates and finished borax. Recent development of open-pit mining techniques which permit almost complete recovery of deposits prompted the shift away from less efficient subterranean methods now in use.

The new plants, to be com-

pleted by mid-1957, are necessary to handle the additional variety of ores recovered in the new type of operation. Their production capacity will exceed that of the company's existing refinery at Wilmington, Calif., which will be devoted to specialty and boric acid products.

#### More Specialty Rubber: A New One and an Old

Two companies have recently announced plans for new plants to produce special synthetic rubbers: new Du Pont-developed Hypalon, a chlorosulfonated polyethylene; Goodyear Tire & Rubber Co.'s Chemigum, a nitrile rubber.

At Beaumont, Tex., Du Pont will complete the first full-scale Hypalon plant early in 1957. Uses for the rubber are in white sidewall tires, wire coverings, floor coverings, chemical tank linings.

Goodyear is making a \$3.5 million addition to its Chemigum and resin plant in Akron, Ohio, which will double present capacity for production of nitrile rubbers and latices used by the paper, textile, paint and rubber industries. Completion is set for next August.

#### Rare Metal from Sulfides Via New Process

Tentative mill site has been selected near Kingman, Ariz., for a \$2½ million hydro-metallurgical mill for selection and recovery of half a dozen rare metals besides recovery of basic metals such as gold, silver, lead, copper and zinc. Arizona-Golconda Metals, Inc., sponsor of the project, proposes to make possible reopening of many closed sulfide zinc mines in the area through custom handling.

Process to be used is new to volume production. Roasting of sulfide ores yields recoverable sulfuric acid and oxides of desired minerals. All oxides soluble in the acid may be taken off; sludges will carry the rare metals. The plant will precipitate half with ferric hydroxide, get the rest out with powdered metallic zinc.

# Use Acids? IF PURITY COMES FIRST there is no second choice...



The 6½-gallon carboy, pioneered by B&A in the reagent field, offers users a compact, "one man package". . . stores more acid in less space.



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## Specify



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For purity . . . for service . . . specify B&A Reagent A.C.S. Acids. There is no second choice.

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#### GENERAL CHEMICAL DIVISION

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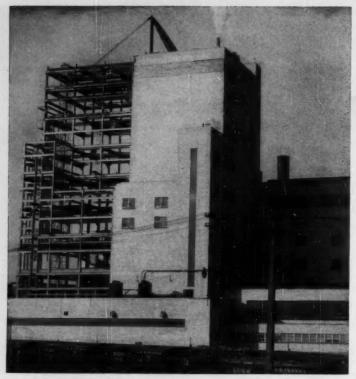
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FULL OUTPUT during reconstruction is the prime benefit from this . . .

#### Lesson in Plant Planning

Despite cramped quarters, Solvay built a new soda ash plant on the site of an old one with no lost production during construction. Here's how they did it!

Building a new production unit on the site of an existing operation without interrupting production is much like playing a tight chess game, as engineers of Allied Chemical & Dye Corp.'s Solvay Process Div. can now testify.

Solvay's new soda ash plant at Syracuse, N. Y., is the case in point. It replaced an old unit at the same site, portions of which had been running continuously for more than four decades.

The master plan called for clearing enough of the old site to permit erecting half the new plant, then shutting down and demolishing half the old plant, followed by completion of the new construction and final demolition of the old. During all this maneuvering, production had to be kept at full capacity.

The new plant has now been in full operation for about a year, though final demolition was completed only recently.

▶ Familiarity Breeds Success— The project required precise calculation, careful attention to detail and a high degree of skill in execution. Everything had to fit to perfection, for space was at a premium.

Plant operators on several occasions came up with suggestions that let considerable work be done without waiting for a scheduled outage. Their familiarity with the old plant—like knowing the location of idle connections—was a windfall to the engineers.

Pipe routes were decided on the spot; it was just impractical to plan such details on the drawing board. Getting lines through an area already congested with equipment, building steel, and other piping was a major problem. Daily checks were made for "dead" piping or equipment that could be removed to provide more elbow room.

One bit of ingenuity was use of a large rubber ball to cut off a 48-in. gas main. The deflated ball was put into the main through a hole cut in the wall, then filled with air until it sealed off the flow of gas. The unneeded section of main was then taken out without interrupting the gas supply.

▶ Ring Out the Old—Soon after World War II Solvay made a thorough appraisal of the physical condition and rehabilitation potential of the venerable Syracuse soda ash plant.

Some equipment, like the Riedler reciprocating gas compressors, had been in operation for years. These compressors still had high efficiency, but replacement parts were necessarily practically "hand made."

The possibility of replacing equipment in kind within the existing structures was shelved; and there were economic reasons why building a new plant at a new site was impractical.

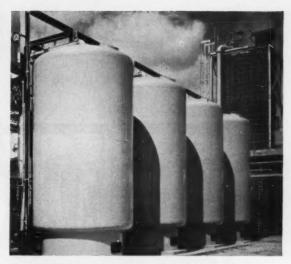
That left only one solution: Erect a new plant as close as possible to the old one, while maintaining full production in the latter.

▶ Ring In the New—The new plant is as modern as the old one was obsolete. With liberal use of tile and glass brick it takes on the architectural aspects of a contemporary apartment or office building.

The inside is just as up-to-date. Although unwilling to publish details, Solvay is justifiably proud of some of the process equipment innovations incorporated in the new plant. With modern equipment and properly applied automatic controls, Solvay is now enjoying the big pay-off—higher operating efficiencies and reduced maintenance costs.



ENGINEERING. Permutit engineers work with your staff or your consulting engineers to design all or any part of your water conditioning system.



EQUIPMENT. Permutit supplies complete equipment. Critical parts such as valves, chemical feeders and controls are designed and made by Permutit.

### How Permutit Solves a Water Problem

U. S. industry is faced with using lower grade water. Results: possible boiler scale, turbine deposits, corrosion of pumps and piping . . . also stains, blisters and other problems in plating, rinsing, dyeing and chemical processing. • For expert answers, more and more management men and their consultants are buying the complete service offered

the field, tackles a water problem:

by leading water-conditioning firms. Here's how Permutit (rhymes with "compute it"), a pioneer and largest in

· Water analysis, study of the problem and past experience provide data on possible methods of treatment. The process offering the best balance of initial and operating cost vs desired quality of treated water is selected.

Complete proposal by Permutit engineers covers type, size and capacity of equipment, price, any special engineering services and performance guarantees.

 Manufacturing — After the proposal is accepted, Permutit designs the entire

project, schedules assembly and shipping. Critical parts, ion exchange resins, control panels are all made in Permutit plants. (No other U. S. firm makes all these components.)

• Test runs - Where required, Permutit checks the installation, supervises start-up and initial operation, trains permanent operating personnel.

· For further information look up the Permutit office in your city or write to The Permutit Company, Dept. CE-1, 330 West 42nd St., New York 36, N. Y.



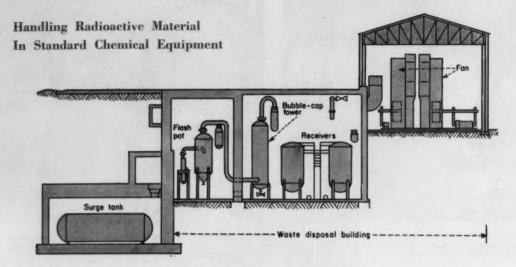
WATER ANALYSIS. Permutit's modern water-analysis laboratory tests over 1200 samples a month!



ION EXCHANGE RESINS. Permutit makes its own ion exchange resins, natural and synthetic zeolites.



**AUTOMATIC CONTROLS to ensure** optimum results are designed, assembled, wired and tested by Permutit.



### Unique Uranium Reprocessing Plant

#### **Designed for Direct Maintenance**

One day (within 50 years) chemical reprocessing of spent fuel from nuclear reactors will be big business in this country.

An essential part of any commercial nuclear power system, separation of fission byproducts from unreacted uranium will involve some difficult problems. A major one—equipment maintenance. This is one reason why progress in reprocessing hasn't developed as rapidly as reactor technology.

But from recently released information, it now looks as if a big step forward has been taken in the design of fuel-reprocessing plants.

For at Idaho Falls, Idaho, Phillips Petroleum Co., operating a "production-scale" plant for the Atomic Energy Commission, is demonstrating the practicability of a simplifying concept—direct maintenance of equipment exposed to intense radioactivity, eliminating the need for remotely controlled tools.

Decontaminating equipment to low radiation levels with chemical solutions permits maintenance personnel to work directly on the equipment. Other reprocessing plants in this country (all, except the Idaho plant, are actually pilot plants) are designed for remote maintenance with remotely operated tools.

At the Idaho Chemical Processing Plant (ICPP), spent reactor fuel from an adjacent Materials Testing Reactor is dissolved in nitric acid, and uranium separated from fission byproducts by extraction with methyl isobutyl ketone. The uranium, in solution, is sent to another plant for further processing into solid fuel.

▶ Why Direct Maintenance?— Either remote or direct maintenance can be applied to such a basic process, but each has important effects on operating costs and capital investment in the plant and equipment.

For instance, at ICPP, maintenance work, after decontamination, proceeds as in most chemical plants. The benefit? Standard, readily available varieties of chemical process equipment are used, shielded from each other and from personnel by thick concrete walls.

In a remote-maintenance plant, service or repair work (and sometimes replacements) are carried out on radioactive (hot) equipment which has been simply flushed free of process material. Remote-controlled tools are manipulated by operators looking through telescopes or thick shielding windows. This means specially designed, expensive equipment—pumps, valves, fittings, placed so that they can be repaired or removed remotely.

▶ How ICPP Decontaminates— On the other hand, chemical decontamination of a properly designed system requires just two basic elements—chemical solutions and time. Here is a typical cycle for a dissolving tank:

 First, thorough flushing with water and steam, outside and inside the equipment.

• Then these chemical solutions in order (all at boiling temperatures):

(1) 10% nitric acid, (2) 10% citric acid, (3) 10% sodium hydroxide-2.5% tartaric acid and (4) 10% citric acid.

This decontamination cycle takes six days to reduce radioactivity from 4.5 to 0.05 Roentgen/hr.\*

Other agents that can be used

<sup>\*</sup>A measure of the dose of radiation anyone in the area would be subjected to. The international tolerance dose rate is 0.3 r/hr. in one week.

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to buy

## Formaldehyde

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#### **NITROGEN DIVISION**

You can order Formaldehyde of highest purity in EIGHT different concentrations from Nitrogen Division.

Get the concentration meeting your needs inhibited or low methanol—from one of the largest producers of Formaldehyde for industrial use.

Ask for technical assistance to help you find just the right concentration for your particular process. Ask too, for samples and quotations!

#### Choose from these 8 concentrations:

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37% Inhibited (6%-7% Methanol)

37% Inhibited (10%-15% Methanol)

44% Low Methanol

44% Inhibited

45% Low Methanol

50% Low Methanol

also

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#### Use U.F. Concentrate—85 to Produce Urea Resins!

59% Formaldehyde—26% Urea
A total of 85% active ingredients!
Makes costs go down.
Increase kettle charge.
Decrease cycle time.
Pay no more than for
less concentrated forms.



include: 10% oxalic acid, 0.003 molar periodic acid (HIO<sub>4</sub>) and 3% sodium fluoride-20% nitric acid.

► Not a Panacea—The ICPP design is not considered, by some experts in the field, to be a final or complete answer to the reprocessing problem.

Chemical decontamination takes time—a disadvantage which increases in severity as the size and capital investment of the plant increases, particularly if the plant has to be shut down

Direct-maintenance advocates claim, however, that calls for repair or maintenance requiring plant shutdown should be few and far between. Phillips estimates that at ICPP two months downtime will be necessary out of 12.

Proper construction materials, a minimum number of valves, welding of most pipe connections, thorough leak-testing of all equipment before startup, can cut maintenance requirements way down. And critical, high-maintenance items (jets, valves, pumps) can be installed, as at ICPP, in pairs, each in a lead-shielded cubicle outside the main equipment cells. While one member of the pair is on stream, the other is being decontaminated and serviced.

Need For Reprocessing—With all the research and development going on in the atomic energy program, it's difficult to predict just how maintenance will be handled, or what process will be used in reprocessing plants, by the time commercial reactors are well established.

Reactor design ties in closely with reprocessing design. For instance, ICPP can process fuel from a slow-neutron, solid-fuel reactor, and can service a number of reactors—it's not economical to recover uranium from a single, small reactor.

That reprocessing will be required there is little doubt. It's not possible to use up all the fissionable fuel in a reactor. Uranium-235, when bombarded with neutrons, forms fission products (zinc to gadolinium) and other neutrons. The concentration of these fission products—which consume neutrons—eventually builds up to a point where the

#### **Convention Calendar**

Society of Plastics Engineers, twelfth annual conference, Hotel Statler, Cleveland, Jan. 18-20.

Seventh Plant Maintenance & Engineering Show, Commercial Museum and Convention Hall, Philadelphia, Jan. 23-26.

Canadian Pulp and Paper Assn., technical section, annual meeting, Mount Royal Hotel, Montreal, Jan. 25-27.

Assn. of American Soap & Gylerine Producers, annual industry convention, Waldorf-Astoria, New York, Jan. 25-27.

American Institute of Electrical Engineers, winter general meeting, includes sessions on electrical developments in the chemical industry, Statler Hotel, New York, Jan. 30-Feb. 3.

Chemical Market Research Assn., "Aromatic Chemicals," Webster Hall, Pittsburgh, Pa., Feb. 1-2.

Society of the Plastics Industry, reinforced plastics division, eleventh annual conference, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J., Feb. 7-9.

Institute of Statistics, "Statistics Short Course for Industry and Physical Sciences." Fee: \$100; North Carolina State College, Raleigh, N. C., Feb. 12-18.

reaction is no longer selfsustaining. Then the fuel must be purified of these product poisons in a reprocessing plant, and recycled to the reactor. At ICPP, this purification is done with only a 5% loss of uranium.

► How Process Works—Actually the process isn't complicated. After four days of storing (cooling) to permit some decay of fission products, the spent uranium rods, and their aluminum jackets, are dissolved in nitric acid. The solution is filtered through a stainless steel sintered filter, adjusted for specific gravity and made slightly basic with ammonium hydroxide.

Then it's pumped through three extraction-stripping-concentration cycles in series. Uranium is preferentially extracted with liquid methyl isobutyl ketone in the bottom section of each extractor, then scrubbed at the top with an aluminum nitrate solution.

The solvent in the first cycle contains uranium and some fission products. It's contacted with dilute nitric in the stripping column, where the uranium and fission products are back-extracted into the aqueous phase.

A new feed for the next cycle is prepared in evaporators, and the cycle repeated. Each time, fission products are removed in the aqueous phase coming out of the extractor column; the bulk of plutonium comes out with the first cycle aqueous phase.

In the final evaporator, uranium is concentrated to a 16% solution, then shipped to another site for more processing.

Raffinates are concentrated to about 75% of original volume and stored; first cycle material is handled separately, while second and third cycle raffinates are combined. Two 300,000-gal. stainless steel tanks are used for permanent storage, enclosed in concrete and buried under 10 ft. of earth.

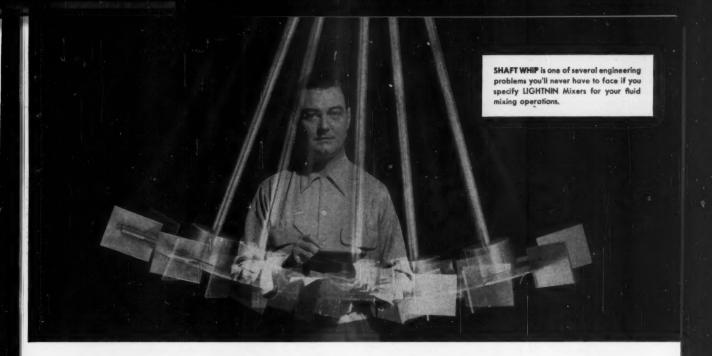
Solvent is mixed with a 2% NaOH solution and distilled in a four-plate bubble-cap column to remove decomposition products.

Gaseous wastes are discharged directly to the atmosphere through a 250-ft. stack, after filtration through a fibrous glass bed and dilution with air.

#### Canada to Produce More Cement

Good-sized cement plants in two Canadian provinces are due for completion by July of this year.

Saskatchewan Cement Corp. Ltd. has been formed to build an \$8 million, 850,000 bbl./yr. plant in Regina. Seasonal cement shortages have slowed construction in Saskatchewan for the last five years, in spite of imports from the U. S.—at \$2.40 per sack



#### How to control shaft whip when you mix fluids

This is a picture of how not to mix fluids.

You know the phenomenon. A threeinch steel shaft, suspended from a rigid mount, is rotating at a speed close to its natural vibration frequency. Without warning, the shaft begins to whip back and forth like a pendulum—farther and farther, faster and faster—until it snaps.

If this happens inside one of your tanks, you're in for a costly repair bill.

It can't happen when you mix with LIGHTNIN Mixers.

#### How to beat shaft whip

We've tortured hundreds of perfectly good mixer shafts in our lab, just to make sure you'll never break one. Our engineers know just how fast a shaft and impeller can rotate, in liquid or in air, without getting too close to the "critical speed." That goes for shafts of any material, any diameter, any length.

How else does this give you better mixing? Well, if you can use a long overhung shaft in a tank, without having to steady it at the bottom, you avoid the upkeep and operating problems of a steady bearing. That can be a big item if you're mixing corrosives or abrasives. Then, too, if you're using a rotary mechanical seal on a closed tank, you'll want the shaft to run true at all times, to minimize wear on the seal faces.

#### Here's why you save

We can tell you just how long a shaft, of any diameter, you can use without going to a steady bearing; or conversely, what diameter a shaft of given length should have if you want to keep runout within well-defined safe operat-

ing limits.

This is just one reason why you save time and cost by mixing with LIGHT-NINS. You avoid risk, too. Every LIGHTNIN Mixer is unconditionally guaranteed to do the job for which it is recommended.

Why not find out, today, how easy it is to get the fluid mixing results you want? Just call your LIGHTNIN representative (listed in Chemical Engineering Catalog). Or write us for specific information that will help you.



HANDLE ALMOST ANY fluid mixing job with these versatile Series "E" LIGHTNIN Mixers, You can get them in sizes from 1 to 500 HP; for open or closed tanks, top or bottom entering; in hundreds of power-speed combinations.



MAKE ANY OPEN TANK an efficient mixing vessel, by adding a LIGHTNIN Portable Mixer. Thousands in use, many for 20 years and more. Thirty models, 1/8 to 3 HP.



IN LARGE TANKS (up to 6 million gallons) you can mix, blend, circulate, suspend solids efficiently with LIGHTNIN Side Entering Mixes. No shuldowns are ever necessary to repack stuffing box or replace mechanical seal. Sizes 1 to 25 HP.

"Lightnin" Mixers...

MIXCO fluid mixing specialists

Get these helpful facts on mixing: cost-cutting ideas on mixer selection; best type of vessel; installation and operating hints; full description of LIGHTNIN Mixers. Free—no obligation, Just check data you want, tear out and mail to us today with your name

and company address.

DH-50 and DH-51 Laboratory Mixers

B-102 Top Entering Mixers (turbine and paddle types)

B-103 Top Entering Mixers (propeller types)

☐ B-104 Side Entering Mixers

☐ B-107 Mixing Data Sheet

B-108 Portable Mixers (electric and air driven)

B-109 Condensed Catalog (complete line)

B-111 LIGHTNIN Rotary Mechanical Seals

MIXING EQUIPMENT Co., Inc., 128-a Mt. Read Blvd., Rochester 11, N. Y. In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.

compared with the domestic price of \$1.75.

Inland Cement Co., at Edmonton, Alta., is building an \$11 million, 1.8-million-bbl./yr. portland cement plant. Capacity is double that originally planned for the plant because of favorable market conditions.

### Two New Plants For Fluorine Chemicals

New plants of Davison Chemical Co. and Pennsylvania Salt Mfg. Co. will boost production of both organic and inorganic fluorine chemicals. Davison has just completed facilities at Lansing. Mich., for hydrofluoric acid for water fluoridation. The company's total capacity is now more than 14,000 tons/yr., making possible a three-fold increase in its acid sales. Pennsalt expects to begin operations of a large organic fluorine chemicals plant this year at Calvert City, Ky. Initial production will serve the refrigerant and aerosol-propellant markets.

Davison has in the engineering stage additional facilities for the acid, which is derived as a coproduct from its production of superphosphate fertilizer. Although the company also supplies fluoride salts for water fluoridation, there's growing demand for liquid sources of the chemical because they permit simpler means of addition to water supplies. Installations completed or projected for Chicago, St. Louis, Philadelphia and Baltimore have all been designed for use of the acid.

Pennsalt, itself a producer of hydrofluoric acid—in anhydrous form—will draw on output of an existing plant in Calvert City to supply the new organic fluorine chemicals plant. This, plus the company's chlorine-caustic unit at the same location, places the new plant in a favorable raw materials position.

#### New Producer For Barium-Carbonate

Sherwin-Williams Co. has started production of 7,500 tons/yr. of barium carbonate at its Coffeyville, Kan., plant. Entry into the barium carbonate field is a logical extension of the company's long-time processing of barytes ore for production of lithopone, leaded zinc and zinc

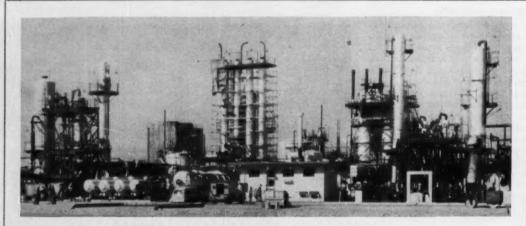
sulfate at Coffeyville. Little additional equipment was necessary to get into production of the new product.

Part of the barium carbonate will go into barium citrate, which the company manufactures for use in some of its paints. Bulk of the production, however, will go to oil additive manufacturers, refractory manufacturing and processing industries.

#### GAF Expands Syndets, Chlor-Alkali

A new liquid detergents plant in Calvert City, Ky., expansion of similar facilities in Linden, N. J., and a new 50-ton/day, \$5 million chlor-alkali plant are all scheduled for completion this year by General Aniline & Film Corp.

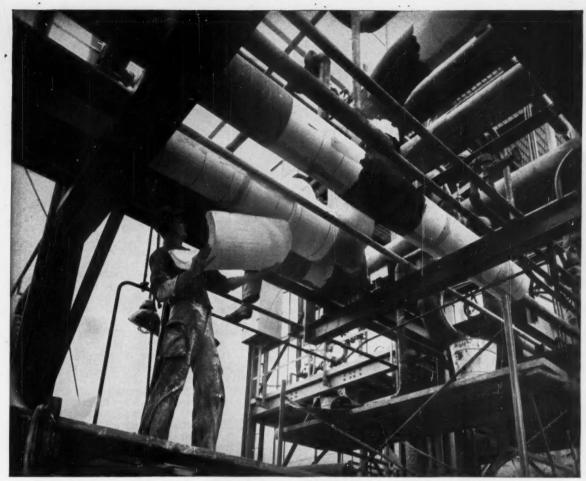
The detergents plants will produce alkyl phenols, nonionic surfactants and the sodium and ammonium salts of their sulfate esters. The new Linden plant will use the Mathieson mercury cell electrolytic process to make chlorine, caustic soda and other chemicals for the company's own



#### First Commercial Isophthalic Acid Plant Gets Into Production

Oronite Chemical Co. is now just starting up its 50-million-lb./yr. isophthalic acid plant in Richmond, Calif. First commercial source of the chemical, a likely substitute for phthalic anhydride in plastics and surface coatings, the plant derives high-purity

product by oxidation of m-xylene (Chem. Eng., July 1954, p. 112). To cost 23¢/lb. compared with phthalic's 20¢/lb., isophthalic acid means lower equipment costs to processors because its lower volatility eliminates the need for closed resin kettles.



J-M 85% Magnesia is lightweight . . . easy for workmen to install half-sections on this 10" steam line. Insulation work at the Grace Chemical plant was performed by Young Sales Corporation of St. Louis. Engineering and construction was directed by Foster Wheeler Corporation of New York.

## Your Btu's and dollars go further when you specify Johns-Manville 85% Magnesia

... the choice of insulation engineers at Grace Chemical's new Memphis plant

INDUSTRY'S LONG-TIME standard for temperatures to 600F is still your best insulation buy. For J-M 85% Magnesia provides high insulating value, easy application, long life, initial low cost and minimum maintenance. That's why insulation engineers consistently specify J-M 85% Magnesia for modern installations like Grace Chemical's new anhydrous ammonia-urea plant. That's why it will pay you to specify J-M 85% Magnesia for your new plant or modernization program.

To assure you maximum value from your insulation dollar, Johns-Manville gives you complete drawing-board-to-job-site service. You get expert recommendations by the world's most experienced insulation engineers . . . plus expert installation by authorized J-M Insulation Contractors. Write today for further information on J-M 85 % Magnesia and Johns-Manville's unmatched facilities to solve your insulation problems. Address Johns-Manville Box 60, New York 16, N.Y. In Canada, Port Credit, Ontario.



J-M 85% Magnesia also comes in block form. Here you see it being applied to a vertical drum at a New Jersey petroleum refinery.



Johns-Manville firstin INSULATION

### Safety Extras Build to an Imposing Record

A little extra safety pressure applied over a large area of workers and routines places National Pet on the verge of a near-perfect safety year for 1955.



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MANDATORY at National Petro-Chemicals is a course in fire safety for all employees (top), tests for combustibles before vehicles enter danger areas (left), gas masks when checking valves on chlorine cars.

ESPITE the hazardous nature, substantial size and wide variety of its operations at Tuscola, Ill., National Petro-Chemicals Corp. is well on the way toward chalking up an almost perfect safety record for 1955. The \$50-million plant had just one lost-time injury among its 640 employees during the first three quarters of the year.

This record is management's well earned reward from making safety a part of the every-day routine of every worker. Typical of its unusually broad-gage, hard-hitting program:

• Just after hiring, all employees get a training session of at least eight hours devoted to the basic principles of fire prevention and fire fighting.

 Every plant employee practices putting out various types of test fires with appropriate extinguishers.

• At the chlorine unloading spur, employees consistently wear air-supplied respirators when breaking connections on the tank cars.

• In some plant areas, Explosimeter tests are always made for the presence of combustible vapors before any autos or trucks are permitted to enter.

Integrated System—The distinguishing "extra" element and secret-of-success in National Pet's program is, of course, betrayed by words like all and every, consistently and always. Says Howard Morris, supervisor of public relations and training: "We have tried to plan and carry into effect an over-all and integrated system of protection rather than going at it piecemeal."

NPC management has long been convinced that the high price of such a system is many times counterbalanced by its benefits—measured in terms of physical equipment and employees' time.

▶ Plant-Wide Indoctrination — First-hand training of all new employees, given in addition to



Garfield, Utah, to store various chemical products.



TANKS PROVIDE STORAGE FOR. SULPHURIC AND PHOSPHORIC ACID

The Western Phosphates, Inc., Garfield, Utah, is one of many companies using Chicago Bridge & Iron Company tanks to store various chemical products. Among the liquids stored in the CB&I field erected tanks at Garfield are sulphuric and phosphoric acid used in the manufacture of superphosphate and ammonium phosphate.

If you have a storage problem, need pressure vessels or special steel plate structures, write our nearest office for information.

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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.



classroom and film sessions, is done weekly at a demonstration grounds set up in a 9,000-sq. ft., limestone-vovered area safely distant from processing units. This area has a centrally located, 400-sq. ft. concrete pad. There's a steel tank 15 ft. in diameter and 4½ ft. high in which various types of oil fires are ignited. Other practice provisions include facilities for simulating trench fires and "gasket-failure" fires.

Gasoline, ether, waste oil and propane are among the combustibles used in practice. Each of the many types of extinguishing techniques available at the plant is demonstrated, including drychemical, foam and water-fog.

An important element of training is practice in the use of the two main types of respiratory protective equipment provided by the company—Chemox self-generating oxygen breathing apparatus and canister-type gas masks for protection against specific gases, such as chlorine.

► Insistent Routines — Precautions like the following constantly renew employees' awareness of the importance of safety:

Workers in areas where chlorine is stored or handled carry compact, pocket-type respirators that can be put on quickly for protection against low concentrations of acid vapors. These permit escape in an emergency and have replaceable cartridges. For workmen breaking connections on chlorine tank cars, air is piped to the unloading platform; the hose lines of their ever-present masks can be plugged into any of numerous outlets with quick-acting connecting valves. Hose lines have pressure reducers and filters.

Gases and liquids with low flash points are a common, continuing hazard at Tuscola. Three of the principal materials handled have ignition temperatures below the surface temperature of the plant's process steam lines which carry 600 psi, steam at 750 F. Thus, leaks in tanks or in process piping are of great concern.

Frequent tests are made throughout the plant with portable Explosimeters that detect combustible gases. These instruments are also used to check tanks and piping before any welding is permitted in the vicinity. In certain plant areas an inspector probes the ground and nearby pipes and equipment before any car or truck enters.

The plant also uses a new type of instrument—an aromatic hydrocarbon detector — to determine toxic concentrations of benzene and toluene. The small, hand-operated aspirator-bulb device has three separate calibrations for aromatics and quickly gives concentration readings in parts per million. This instrument was developed by Mine Safety Appliances Co.

▶ Well Equipped—National Pet owns a multipurpose fire truck distinctive in the size and type of equipment it carries: A 50-gal. tank of foam liquid and a foam proportioner built directly into the piping system; a ton of drychemical extinguisher that can be expelled (with nitrogen) on a fire in about two minutes; a four-wheel trailer with additional drums of foam solution.

In process areas there are 14 strategically located quick-acting hose-reel stations. Also in these areas are cabinets containing Chemox breathing apparatus and asbestos suits and gloves. Steel cases, fixed upright to structural columns in strategic locations, contain fire blankets that can be pulled out quickly to envelop a fire victim and extinguish flames.

To facilitate the fire-fighting plan, alarms are transmitted by dial telephone to guard headquarters over an extension reserved exclusively for this purpose.

▶ Well Staffed—Safety and fire prevention are the direct responsibilities of the plant protection and training department. There are two full-time fire and safety inspectors, one full-time fire marshall and a chief of guards. Also, a regular fire patrol is maintained throughout the plant. A central safety committee, empowered by management to establish safety policies, meets monthly; and a plant safety in-



For Compact City Plant, Fire Training in Parking Lot

At its Brooklyn, N. Y., plant Chas. Pazer & Co. adapts fire training to city quarters and the hazards peculiar to pharmaceutical manufacture. A company parking lot provides hard-to-get

space for weekly student-participation fire demonstrations. Every production and research employee attends one, handles different extinguishers to put out simulated laboratory fires.



1,600,000 cubic feet per day... that's the combined capacity
of the more than 400 Sharples Super-D-Hydrators in operation...
continuous, automatic production of high purity crystals
at production rates up to 8 tons an hour.

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spection committee inspects the entire plant every week.

Employees assigned to respond to fire alarms as part of their regular duties get at least 60 hours training annually. Normally, 10-12 men trained in fire fighting answer every alarm. In case of a major disaster, a master emergency plan which includes rescue and overhaul work would go into operation. Any man in the plant may be called on to assist designated personnel in fighting fires.

Because of the varied nature of gases and chemicals used and made at Tuscola, fire-fighting crews are trained to identify the gas involved. Each process yields certain known gases and appropriate breathing apparatus or masks are provided to protect against them.

#### More Doings In Canadian Tar Sands

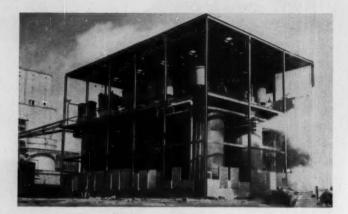
Recent moves for one newcomer and one veteran in the Canadian tar sands picture may presage commercial production of petroleum from that source in the foreseeable future.

The newcomer, Consolidated Mic Mac Oils, Ltd., Edmonton, has just acquired a 50,000-acre block in the Athabasca tar sands area. These sands are said to hold a total of about 350 billion barrels of oil.

The veteran, Can-Amera Oil Sands Development Ltd., Calgary (in partnership with Royalite Oil Co., Ltd.), is tooling up for a commercial process it believes will do the needed separation job.

The company has just bought the Alberta government's experimental extraction plant at Bitumount, plus 5,874 acres of the oil-rich land. Construction has already begun at Bitumount to convert to commercial scale a separation process developed by G. R. Coulson, chief engineer for Can-Amera (see Chem. Eng., June 1955, p. 130).

Full-scale production would call for expenditure of between \$35 and \$50 million to build a 300mi., 10\frac{3}{2}-in. pipeline to Edmonton, a coking plant at the Bitumount site, a sulfur recovery



#### Fermentation Plant Produces Before Walls Are Up

This new pure-culture fermentation plant of Grain Processing Corp. at Muscatine, Iowa, went into operation two months before completion of outer and inner walls and permanent con-

trol panels. In a rush to expand with demands of feed, drug and food industry customers, the company designed construction plans to reverse usual plantbefore-production scheduling.

plant at Edmonton, and full-size separating plants operating in banks of 20.

## Can Automation Control Itself?

All-out use of automation in the chemical and other manufacturing industries is a potential source of at least as many jobs as it destroys and of increased production which will provide more earned leisure time for all.

This much was agreed by all witnesses, representing management, labor and technology, at the automation hearings recently held before the subcommittee of Congress' Joint Committee on the Economic Report. But can it take over smoothly? Or must it be rigidly controlled by outside agencies-probably government spearheaded-lest it run wild, causing prolonged and widespread unemployment before the transition is complete and workers are relocated at the new jobs it creates.

Inclined to the optimistic side were Thomas Walsh, chemical group director of Case Institute of Technology's automation study project and President Don Mitchell of Sylvania Electric Products. Walsh told the subcommittee that, in the case of the chemical and petroleum industries, automation had probably already passed the point where further use would decrease employment. He picks plastics and synthetic fibers as the industry sections next on the list for more automation.

But CIO President Walter Reuther foresees that automation will be accompanied by socio-economic problems that won't solve themselves. He recommended that Congress enact laws providing for low-interest loans for small businesses, more vigilant enforcement of antitrust laws, emergency aid for communities hurt by industrial dislocation, a higher federal minimum wage rate, earlier retirement and increased benefits under Social Security.

Research Director Otto Pragan of the International Chemical Workers Union feels that, rather than government legislation, planning on the plant and company basis is most needed.



## **Inside story:**

Valves may look alike on the surface. Their performance is another story. And the inside story of Powell Valves is that every Powell Valve has Performance Verified.

X-ray and gamma ray inspection—examining the very structure of the metal itself—are two of the many ways that Powell can make absolutely certain that Powell Valves will give dependable flow control.

Every part of every valve must pass rigid inspection. As a final step in manufacture, every Powell Valve is subjected to an actual line test. Because of Powell's pains-taking quality control, valve repair is cut to the minimum and plant shut down through valve failure is substantially reduced. Records from refineries, power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE quality line which has PERFORMANCE VERIFIED.

The Wm. Powell Company, Cincinnati 22, Ohio . . . 110th YEAR



FIG. 2309—Flush Bottom Tank Valve for 150 Pounds W. P. Disc Opens Into Tank.



FIG. 2453G—Stainless Steel
O. S. & Y. Gate Valve for 150
Pounds W. P.



FIG. 3059G—300-Pound Steel Flanged End Lubricated Plug Valve.



**POWELL VALVES** 

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	P	core
Venture A		٦
Venture B	7	+
Chances of Success		
(Maximum 10 points)		٠.
Excellent		10
Good 8		•
Fair 6		
Uncertain 4	4	
Poor 2		
Payoff in Years	-	
(Maximum 20 points)		
0.00.01		
0.00-0.1		
0.21-0.4	17	
0.41-0.8		1
0.81-1.6 8		11
1.61-3.2		
3.21-6.4 2		
	13	
Cash Position in 10 Years		
(Maximum 10 points)		
\$1,500,001-\$5,000,00010		
\$420,001-\$1,500,0008	8	
\$120,001-\$420,0006	-	
\$35,001-\$120,000		1
\$10,000-\$35,000 9		7
Other Pertinent Factors		
(Maximum 10 points)		
Good raw materials position 1	1	
Established outlet 1	1	1
Maintain business and/or major 1	1	·
product	-	
Low investment 1	1	
(under \$750,000)		
Chances of yielding royalties 1	1	1
Chances of eliminating royalty 1	1	
Research benefits realized early 1	1,	
Long range insurance 1	1	,
Moderate research cost 1	1	1
(under \$250,000)	1	
Improved product quality 1	1	1
	1	
Tetal50	37	30
	1	-

#### How to Pick Best Projects

Here's a method that minimizes "chances of success" factor, weighs economics heavily.

How does the probability of success affect the attractiveness of a proposed venture?

Cities Service, for one, deemphasizes this factor when evaluating the relative merits of research projects dealing with petroleum products. As shown at left, it's worth only 10 points out a possible total of 50.

In most other project evaluation methods, the factor for chance of success enters as a multiplier (or divisor) rather than simply being added in. So the Cities Service system tends to minimize the factor's importance.

B. H. Rosen stated recently\* that Cities Service puts greatest emphasis on economics when choosing its most promising petroleum research ventures. Payoff period gets the most weight -20 points-and cash position after 10 years is worth another 10 points. Ten other pertinent factors are worth only 1 each. Gunning for Big Game-Apparently Cities Service is after the big ones. A project that pays off in more than 1.6 years is bound to be rated low. (Payoff is calculated as research plus investment costs divided by annual earnings: the latter is the difference between annual sales and manufacturing costs.)

Not content with payoff as a measure of economic worth, Cities Service assigns premium rating to projects that promise to enrich the corporation's treasury the most. Cash position after 10 years is defined as the sum of gross earnings for 10 years minus the total investment in research and plant (10-yr. write-off), multiplied by a factor of 0.5 for income taxes.

These factors are offset only slightly by one-point premiums given projects that require modest investment or research or that yield early realization of research benefits.

▶ Other Rating Systems—Rosen

\*At a symposium of the New York Section, A.I.Ch.E., Oct. 20, 1955. cites other methods of determining relative values of research projects:

• Esso Research is said to use a formula in which value of a successful solution is multiplied by probability of success and divided by the cost of the work.

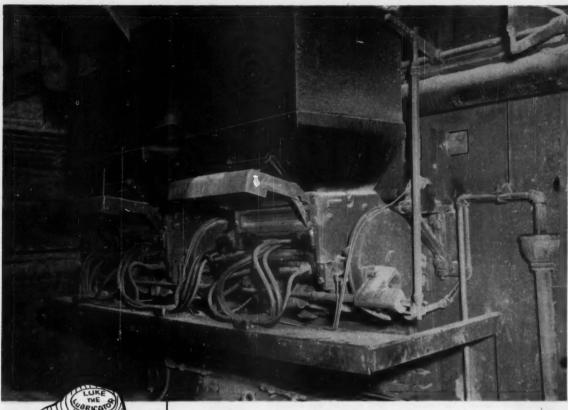
· A somewhat more complex formula is suggested in Perry's "Chemical Business Handbook" in the Research section written by Shell executives. The straight economic rating it gives is adjusted for probability of success by factors obtained from previous research experience. For a minor product or process improvement (a relatively safe venture) economic rating might be divided by 3; a new product in late development stages and produced in conventional equipment might be discounted by a factor of 5: in a new field where research costs, process difficulties and market demand are all uncertain, the rating might be divided by 10 or more.

Matter of Opinion—All rating systems that include a factor for chances of success have a common problem: Who determines the factor, and how?

At Cities Service it's usually obtained by pooling the opinions of informed individuals. Nonetheless, admits Rosen, opinions on chances of success for a given project can range from poor to good, depending on the type of project and the objectivity of the opinion.

Rosen suggests several ways to improve the accuracy of estimated success factors. One is the committee system. Here the broad economic justification for the project can be sensed quickly by seasoned operating, sales and research managers. Another way is constant review of projects in progress.

Finally, he suggests that research groups reappraise completed and discontinued projects to see how original estimates stood up. Future estimates will be improved by such analyses.





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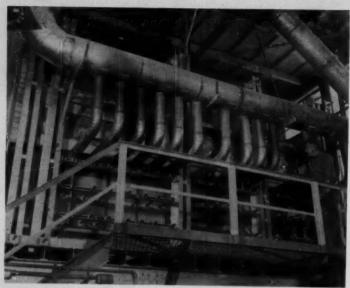
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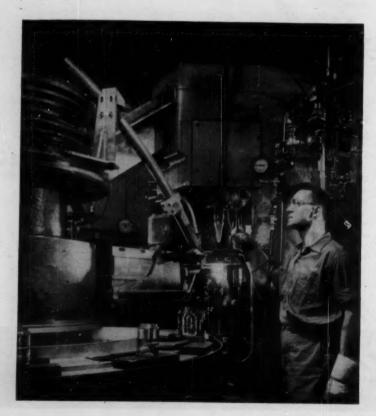
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Oil and Grease Systems

#### GLASS: On the Threshold of a New Era



.25-TON PILOT FURNACE delivers molten glass to new Owens-Illinois machine (below) for containers 20% lighter, yet stronger, than normal.



Commercial realization of more of its theoretical mechanical strength may open new markets for this venerable and versatile material.

As a result of 50 years of technological development, the U. S. glass industry is now enjoying one of its most profitable eras.

In 1954 the industry turned out 7 million tons of glass products—containers, flat glass, fibers and foams—with a sales value of \$1.6 billion. These products serviced not only the retail consumer but also the chemical, electronic, automotive, aircraft and construction industries.

Even greater days are ahead for glass producers and users as more of this age-old material's proven mechanical strength is realized commercially. Special glass fibers have been produced with a tensile strength of 900,000 psi. Yet ordinary glass of commerce breaks at about 10,000 psi.—only 1% or so of the highest measured strength. If this figure could be increased to just 2%, glass objects could be made with as little as half their present weight.

And if the realizable tensile strength could be upped to 10% of proven, glass would quickly come into its own as a major structural material.

► Latest Advances — Working toward this goal, glass companies are conducting intensive research. Owens-Illinois, one of the leaders, pointed up latest progress in glass technology when it revealed three new commercially practical developments at the recent opening of its new technical center in Toledo, Ohio:

• A new process and machine (see cut at left) for making glass containers 20% lighter, yet stronger, than similar containers made by conventional methods. In addition, the machine operates at double present production rates. O-I has two experimental units in use—one at its technical center, the other

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380 Madison Avenue, New York 17, New York



at its container plant in Huntington, W. Va.

 A low-temperature glass solder, already in experimental use in color television tubes.

 A heat-treating process that makes glass containers mechanically stronger and cuts down annealing time.

Lighter and Stronger—O-I's success in producing a lightweight, stronger glass container (a 12-year project) hinges on controlled distribution of glass

during forming.

This is done by controlling temperatures at various points along the surface of the initial mold into which molten glass is poured. If, for example, a thinwalled, thick-based container is wanted, mold temperature varies from low at the bottom to high at the top. When the container is transferred to the second or final mold, the hotter, more fluid walls can therefore be more easily blown while the cooler, more viscous base resists blowing.

Although wide-mouthed jars were the first to benefit from this new process, experiments are now being conducted on narrow-

necked containers.

Phosphates and/or borates get credit for the low melting point (800 F.) of O-I's new glass solder. This solder gives a perfect, lifetime seal between two pieces of glass, but the seal can be opened and released if necessary.

Immediate benefits of the solder are envisioned in the production of low-cost color television picture tubes. Another area of use may be in mending special glass laboratory or plant equip-

ment.

▶ Heat Treating—In the realm of heat treating, O-I has come up with a new process for containers that induces controlled compressive stresses in red-hot glass by sudden, rapid chilling. Products are about three times as strong as ordinary glass.

What happens is that the surface freezes while the interior is still hot and expanding. As the interior cools, it shrinks and tries to pull the surface inward. Since glass breaks in tension and not in compression, tempered glass won't break until the strong

pull of inner forces is overcome.

O-I induces controlled stresses in containers (only in baby-food jars so far) by playing jets of high-pressure air in a predetermined pattern on the inner and outer surfaces of hot containers as they come from the mold. This is done in a matter of seconds, thus eliminating long annealing cycles.

► Fundamental Research — These commercial developments represent the applied research going on to learn more about improving the strength of glass. More fundamental studies are continuing in O-I's labs on the bulk structure of glass atoms and on irregularities or discontinuities in its surface.

In the pilot plant, measurements are made on temperature gradients in glass and metal, temperature and forces required to separate glass from molds, heat-transfer rates from the time glass leaves the furnace to when it exits from the final mold.

► Raw Materials Research — Since silica is a major constituent of glass (typical composition: 72% silica, 14% soda ash, 12.5% lime, 1.5% alumina), it's not surprising that Owens-Illinois has for years been seeking other large-volume outlets for this readily available raw material.

O-I's Kaylo division now makes a lightweight insulation, composed of hydrous calcium silicate, that withstands temperatures to 1,200 F. It's extensively used as a pipe covering. More recently O-I developed another hydrous calcium silicate to withstand temperatures up to 2,000 F., for use in fire doors.

And hydrous calcium silicates may soon be exploited for structural uses. A material containing about 0.7:1 ratio of water to solids, plus a prefoaming agent (for light weight), is now being customer-evaluated. It has a density of 30-40 lb./cu. ft. and is said to combine structural strength with insulating properties. Anticipated applications: Full-size roof slabs and possibly flooring.

Other projects under consideration in the Kaylo division include the study of silicon and many of its compounds.

► The Future — Supply of raw

materials for glass manufacture is practically unlimited. Glass can be transparent or opaque, clear or colored, soft or hard, soluble or insoluble in various chemicals, a conductor or non-conductor of electricity, softened at very high or very low temperatures.

It's no wonder, then, that scientists and engineers are convinced that this really amazing material stands on the threshold of a new era of industrial im-

portance.

#### Zone Refining Studied To Purify Sea Water

Battelle Institute will try to process pure water from the sea by borrowing the principle used in zone refining of metals (see Chem. Eng., May 1954, p. 108): that impurities are usually more soluble in the liquid state of a substance than in the solid. Instead of a molten zone, a frozen one would be used to sweep impurities ahead of it.

Ultimate object of Battelle's government-sponsored study is to get estimates of process economics. The process has at least two technical advantages. It takes less energy to convert water into ice than it does to convert it into the steam needed in distillation processes. And, because most natural sources of water are nearer to water's freezing point than to its boiling point, less energy would be needed to move water through the shorter temperature range to its freezing point.

Water reformed from the ice after freezing would be pure enough for drinking and irrigation if the method proves suc-

cesful.

#### Strong Showing in Aluminum Expansions

Kaiser Aluminum & Chemical Corp., British Aluminium Co., and Aluminium Ltd. have announced expansions in the U. S., Canada and Jamaica, respectively, which pile up a total cost of \$237 million.

Kaiser has a \$90 million expansion program underway which affects five of its plants. At Ta-

in high temperature, low pressure heating

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coma, Wash., \$2.25 million worth of new reduction cells will raise the plant's production of primary aluminum from 67.5 million to 77.5 million lb./yr.; at Mead. Wash., \$300,000 spent on new cells will mean a 3-million-lb./yr. production increase. Biggest single chunk, \$75 million, is going into enlarging and completing initial facilities for a 333.5million-lb./yr. integrated sheet and foil rolling mill already under construction in Ravens-wood, W. Va. At its Chalmette, La., reduction plant, a cryolite recovery plant and facilities for direct chill casting of billet are being installed. And capacity of the company's Halethorpe, Md., extrusion plant will be raised from 24 to 46 million lb./yr.

British Aluminium Co. plans to begin construction this spring of a \$130 million primary aluminum producing plant at Baie Comeau, 200 miles east of Quebec.

And Aluminium Ltd., Canadian aluminum producer, has started a \$17 million expansion program in Jamaica which will more than double its present 230,000 tons/yr. alumina production there.

#### Isosebacic Acid To Come from Tuscola

The world's first commercial plant for sebacic acid isomers will be built by U. S. Industrial Chemicals Co. in Tuscola, Ill. Initial production capacity will be 10 million lb./yr.; completion is scheduled for early 1957.

Called USI Isosebacic acid, the product is made from sodium, which USI produces, and butadiene via a variation of the well known buna rubber synthesis. The company states that Tuscola

was chosen as plant site because of the availability of raw materials such as butane from the nearby petrochemicals plant of USI affiliate National Petro-Chemicals Corp. USI has reached no definite decision to use the butane to produce its own butadiene at Tuscola. But the odds are in its favor (Chem. Eng., June 1955, p. 110).

A \$500,000 isosebacic pilot plant just built in Cincinnati will continue to operate until the new plant comes on stream.

#### Anaconda Eyes Commercial Alumina-from-Clay

Officials of the Anaconda Aluminum Co. at Columbia Falls, Mont., say that while no one has yet economically obtained aluminum oxide from clays they believe they can do it. This, coupled with their confirmation of recent company investigations of local clays in eastern Washington and northern Idaho, may reflect their unconfirmed intention to build an alumina recovery plant in the area.

Several other companies—including Lobeth Corp., Chicago, Harvey Machine Co. and Alcoa—have technically workable alumina-from-clay processes (see Chem. Eng., Oct. 1954, p. 136). But like Anaconda's, none has yet faced the economic tests of full-scale production.

#### Ti Metal Cost Cut; More Ore Found

Du Pont's fourth price cut in titanium in less than two years drops the metal from a high of \$5/lb. to a newly announced \$3.75/lb. for top-grade sponge. Second-grade sponge and its fines are now \$3.25 and \$2.75 respectively.

On the raw materials side, National Lead Co. has just discovered, in Norway and New York, two large ore deposits. The Norwegian find, a probable 300 million tons in Jossingford, may develop into one of the world's largest reserves. In Tahawas, N. Y., a new reserve with a proved 50 million tons gives good indication of containing over 100 million.



#### New Glycerine-Feeder Plant Goes On Stream

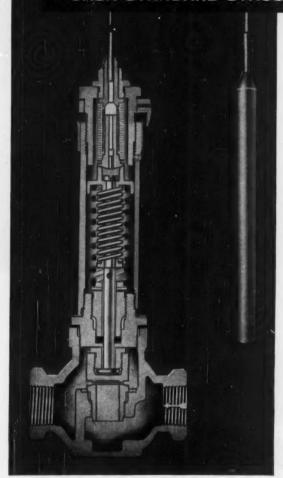
Shell Chemical Corp. has started up a new allyl chloride and chlorohydrin plant at Norco, La. Above, left to right, are chlorohydrin scrubber, two allyl chloride purification columns and propylene fractionator. For now, output will feed the company's glycerine plant in Houston. But more new Norco units are planned, including one de-

signed to make glycerine by a new process starting with hydrogen peroxide and acrolein an acrolein unit; and a unit to make 30 million lb./yr. of non-electrolytic hydrogen peroxide. Also planning commercial use of a nonelectrolytic process for hydrogen peroxide: Columbia Southern Chemical Corp., after five years of pilot-plant tests.

## Cash Standard Expands by the addition of Stacon Temperature Regulators

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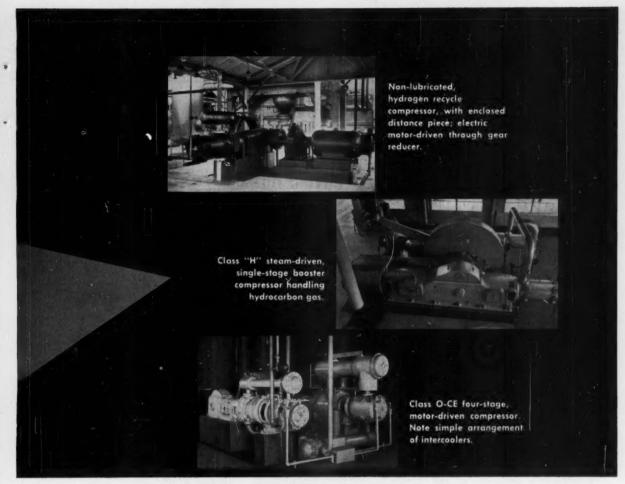
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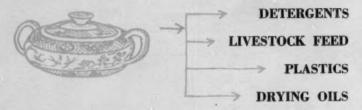
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## **SUGAR**

#### More Than a Sweetener

The same sugar you've been spooning into your coffee is now piquing the curiosity of chemical processors as a new raw materials source.

"There can no longer be any serious doubt concerning the broad question of whether or not there will be an important organic chemical industry based upon sucrose and its byproducts. This is taking form before our very eyes."

With these optimistic words, Henry Hass, president of the Sugar Research Foundation, sums up progress in sucrochemistry—an industry slow to start, but gaining momentum all the time.

At present, sucrose is playing a leading role in at least four projects sponsored by SRF which are on or close to the threshold of commercial realization:

- · Nonionic detergents.
- · Livestock feed from ammoniated beet pulp.
  - Drying oils for paints.
  - Tough, hard, transparent

And others—e.g., agricultural sticking agents, insecticides—are on the way.

▶ Detergents—Foster D. Snell's recent unveiling of a commercial process for making sugarbased detergents (now being pilot-planted by Berkeley Chemical Co., New Jersey) is already attracting attention of a number of firms in the U.S., Mexico, Philippines, South America and Europe.

And no wonder. These detergents have a long list of credits and apparently no debits. They're nontoxic, nonirritating, odorless, tasteless, low foaming.

But more important, they're cheap, solid and only slightly soluble in water—factors putting them in direct competition with anionic detergents (cheap, solid, but irritating and too water-soluble), major nonionic detergents (expensive, ethylene oxide-based liquids), and bar soaps (precipitate calcium and magnesium scums in hard water).

Sugar (8¢/lb.) can replace ethylene oxide (15¢/lb.) in nonionics at about half the cost to yield a detergent selling for about 18¢/lb. And because the resulting products are solid and relatively insoluble in water, they can be formed into detergent bars and shipped in cheap cardboard boxes instead of more expensive glass or steel containers. They have the advantage over soaps-as do all detergents-of eliminating the pesky bathtub ring, nemesis of housewives living in

hard water regions.

How They're Made—Secret of Snell's successful process is the reaction of sucrose with the fatty ester of a volatile alcohol (methyl stearate) in a solvent—one which must dissolve both a

hydrophilic material like sucrose and a fat. An excess of sugar yields the monoester for detergent use. An excess of the fatty ester produces a diester which may also find applications (in food emulsifiers, for example).

Potassium carbonate is the preferred catalyst because, unlike more alkaline catalysts, it won't take part in undesirable side reactions at high temperatures. Choice of solvent is limited; dimethyl formamide, dimethyl sulfoxide or N—methyl pyrrolidone will do the job. (Solvents with —OH groups produce the wrong ester. Those with —NH groups form the amide, while those with ester groups undergo transesterification and produce the wrong ester.)

Facess Sugar Recovered—After the product is dried, it contains about 45% monostearate, 1-2% potassium carbonate and about 54% unconverted sugar and can be used as is. But it's more than likely that economics will dictate that the sugar be recovered by further product purification.

This can be done by dissolving the product in three to four times its weight of water, mixing with salt, heating to 80-90 C. until the sugar ester has layered completely and centrifuging the slurry to remove water. Sugar, salt and product are then redried.

▶ Beet Pulp Feed—Just one step behind the detergents on the road to commercial reality is an entirely different process designed to produce a cattle feed by ammoniating beet pulp.

Chemical engineering has removed the big stumbling block to its successful production—moving bulky beet pulp, a natural insulator, through a high-temperature zone and reacting it with ammonia. The process formerly required both high temperatures and pressures, but is now carried out at low temperatures and pressures (6 psig.).

Tests on cattle show a weight gain per day of 2.1 lb. with cottonseed meal (control) com-

#### Johns-Manville announces a new line of Filter Aids



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DIATOMITE—Celite's unique particles provide highest clarity at fastest flow rates.

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Combining the excellent adsorption properties of selected and processed asbestos fibres with the high flow rates of Celite\* diatomite, Johns-Manville offers this PRE-MIXED filter aid to those requiring superior filtration of liquids.

Johns-Manville, the world's largest producer of both Asbestos AND Diatomite, selects materials from each of its mines and carefully blends them into a number of grades. In addition, strict uniformity is maintained for each grade so that you may choose the exact mixture you require, relying on this uniformity for all future orders.

Fibra-Flo is now available in carload quantities. Use the coupon below to get further information.

#### FIBRA-FLO offers the following advantages to your filtration process:

- 1. Improved clarity more quickly obtained.—Increased production.
- 2. Filter cake more easily parted from screen.—Labor savings.
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#### Newsworthy chemicals this month.

Sugar as a raw materials source142A	General-purpose plasticizer
Cellulose propionate plastic144A	Conductive floor waxes
Absorbent, free-flowing silicate146A	Acid-stable penicillins
Kel-F oils and waxes146B	One-part, epoxy-based adhesive150E
Alkyd resin improves baking enamels146C	Chemicals from lignite150F
Acetate yarn for industrial belting148A	Azelaic-based lubricant esters150G
High-voltage insulating rubber148B	Fiber-reinforced Teflon sheet150H
Polyglycol ethers148C	Pyromellitic acid and dianhydride1501
Barrier coating for polyethylene148D	Purest dimethyl alkyl tertiary amines150J
Rubber-sized fiber	Zinc-rich paint protects iron, steel150K

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pared with 2.5 lb. for the ammoniated pulp.

Though details of the process have not yet been revealed it's a sure bet that a large Western sugar company will be going into commercial production of the new feed some time next summer.

Drying Oils-Mastery of economic production may put still another sucrose product on the market. Sucrose-linseed oil fatty acid esters have been synthesized and tested by National Lead with excellent resultshighly superior paint films both as to drying time and hardness.

The theory behind use of sugar in such an oil composition is this: drying time increases with the number of unsaturated fatty acid groups in the oil molecule, e.g., drying ranges from infinitely slow (methanollinseed oil ester) to rapid (pentaerythritol-linseed oil ester). Thus sugar, with eight hydroxyl groups, could theoretically hook up with eight unsaturated fatty acid molecules to yield a rapid drying oil.

More than six fatty acid groups have been incorporated into the sucrose molecule-compared to a maximum of four

obtainable with pentaerythritol. But work is continuing in an attempt to produce even superior esters by economical means. If successful, large quantities of refined sugar will have a ready market in the \$1.4 billion paint industry.

Resins-Reductive aminolysis of sugar, developed at Pennsylvania State University, may open the door for sugar's entry into the field of high polymers. The reaction of sucrose, ammonia and hydrogen in the presence of a nickel catalyst yields 2-methylpiperazine, a key starting material in resin and fiber production.

Preliminary lab experiments involving the reaction of a readily available dibasic acid with 2-methylpiperazine have yielded a tough, hard, transparent plastic. And rumor has it that one of the major chemical companies has two new fibers based on a similar type of reaction.

▶ Byproducts in Demand—Contrasted with sucrose's slow but steady climb up the ladder of industrial success is the position of its byproducts-already on the top rung of the ladder.

Bagasse (fibrous residue from sugar cane), usually burned under sugar mill boilers, serves as a vital raw material in a variety of chemical industries: Celotex (insulation against sound and heat), pulp as paper (newsprint, fine writing paper, bags, cardboard), furfural (Du Pont has contracted to absorb the bulk of South Porto Rico Sugar Co.'s 30 million pounds annual output of furfural for

use in nylon manufacture), resin stock (phonograph records).

Cane filter muds are a source of cane wax, having some of the properties of carnauba wax. Molasses' biggest market at present is cattle feed. But immature cane molasses contains aconitic acid which is also used in preparing aconitate esters. plasticizers for vinylidene polymers. And beet molasses is the starting material for production of monosodium glutamate.

What's Ahead—This sums up

most of the important sucrochemistry developments to date.

Sugar research in the past was concerned chiefly with problems of structure and configuration. Present efforts are directed at calling attention to sugar's potential as a cheap, abundant chemical raw material. The future is anybody's guess, but it appears that the white crystalline powder you see in your sugar bowl is headed for a new and busy life.

#### Cellulose Propionate

Sets sights on cellulose acetate butyrate market.

Taking dead aim on the 40-50 million lb. yearly sales of cellulose acetate butyrate, Celanese last November swung into commercial production of cellulose propionate plastic, trade-named Forticel. This marks the first volume availability of the propionate in this country (semiworks production was discon-

For More Information . .



about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.





### OTHER HEYDEN INTERMEDIATES

o-Chlorobenzaldehyde p-Chlorobenzaldehyde o-Chlorobenzoic Acid p-Chlorobenzoic Acid 2,4-Dichlorobenzoic Acid 3,4-Dichlorobenzoic Acid

### HEYDEN BENZALDEHYDE

a versatile intermediate for dyes, pharmaceuticals, chemicals, essential oils... and YOUR NEW PRODUCT!

Some of the applications for Benzaldehyde, such as in flavors and odorants, depend on the physical properties of volatility, odor and taste. Other uses—for instance, in the synthesis of dyes and drugs—are based on its chemical reactivity.

Which of these properties—physical or chemical—are of interest in the development of your new product? Heyden, the leading manufacturer of Benzaldehyde, offers two grades designed for various uses. The unsurpassed purity of Heyden Benzaldehyde N.F. (F.F.C.) makes it the preferred product for the formulation of cosmetics, odorants and flavoring agents. For use in organic syntheses, Heyden Benzaldehyde Technical can be depended upon for high quality and uniformity.

The Heyden sales office nearest you will welcome the opportunity to discuss your requirements, or see that you receive samples and technical information.



tinued during Korea War due to shortage of paper pulp).

Although belonging to the same family of plastics, the propionate is claimed to have some advantages over the butyrate: it's a little harder; is odorless, even at high temperatures of injection molding; has a little better abrasion resistance: and molds more easily than the butyrate. And, at

62¢/lb., Forticel's price is close to cellulose acetate butyrate's.

Backed up by assured captive sources of high quality propionic acid and alpha cellulose, Celanese is set to vie for such markets as fountain pens, telephones, appliance housings, where the butyrate plastic now is entrenched.-Celanese Corp. of America, New York 16, N. Y.





#### **Powder Plus Water Equals Powder**

That thirsty powder soaking up the water in the photo is a new synthetic calcium silicate called Micro-Cel. It will absorb twice its own weight in liquids and still remain free-flowing. Just as striking: it will absorb up to six times its weight in water before it becomes a paste. This capacity puts Micro-Cel well ahead of clays, tales, calcium carbonate, even ahead of diatomites like Johns-Manville's own Celite, and gives it a big edge as an absorbent-grinding aid for high concentrate insecticide wettable powders, as an anti-caking aid in fertilizers, insecticide dust, cleansers and detergents.

Here are several samples of the high concentrations of insecticides achieved by Micro-Cel in wettable powders: Toxaphene, 70% (compared to 40% before); Aldrin 75% (compared to 50% before); Heptachlor, 50% (compared to 25% before); and 75% dieldrin (compared to 50% before). Micro-Cel is priced at 6-10¢/lb. Coating clays are 3-4¢/lb.; diatomites, 1-3¢/lb. Micro-Cel's surface area (95-175 sq. meters/gm.) is also ahead of clays and diatomites, makes the silicate a natural for flatting agents, pigment extenders, bulking agents, viscosity controllers. -Johns-Manville, New York 16, N. Y. 146A

#### Kel-F Oils, Waxes

Meet the severe demands of industrial operation.

You can now buy fluorocarbon sealants, lubricants and fluids to use in processing at high temperatures and pressures, and in the face of extremely corrosive conditions. Here are some suggested end uses to consider:

· Compressor lubricantsfor high pressure, high capacity chemical requiring systems inertness, thermal stability. good flow and load-bearing characteristics, nonflammability.

· Heat transfer media-Kel-F oils have a high degree of auto-convection, are resistant to thermal and chemical breakdown for long periods and possess thermodynamic properties approximating the ideal for refrigeration systems.

· Sealants and lubes for plug cocks and valves-resistant to oxidation, corrosion and gumming for long periods over a wide temperature range. Excellent for metal, glass and ceramic plug cocks handling acids, alkalis, halogens and oxidants. They prevent valves from freezing and leaking from direct contact with steam, hot water or corrosive chemicals.

· Organic reaction and extraction media.

• Aromatic-aliphatic ration in petroleum refining.

· Mold release for rubber and plastics.

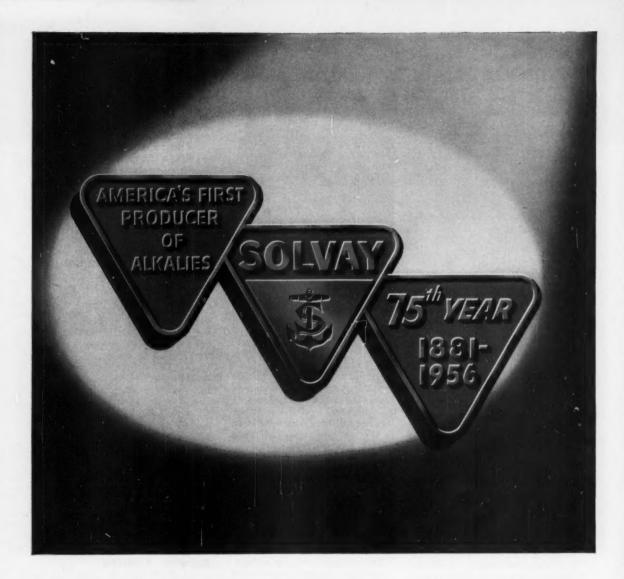
· Spray-on wax coatings for alkali and acid cleaning baths and for corrosion protection of oxygen systems.-M. W. Kellogg Co., Jersey City 3, N. J. 146B

#### Alkyd Resin

Improves quality of industrial baking enamels.

Duraplex ND-76, a new alkyd resin, lends greater color stability resistance to alkalis and soaps, and mar resistance to enamels formulated with it. This is particularly desirable for the white enamels used on refrigerators, stoves, washing machines, etc.

Specifically, these are the claims for enamels incorporat-



#### SOLVAY'S 75th YEAR

As America's pioneer producer of alkalies, we are proud of the contributions Solvay has made to the dynamic growth of American Industry during the past 75 years.

It is natural to look at our 75th year as a mark of achievement.

Be assured that in the years of industrial development ahead Solvay products and service will continue to set the pace of leadership.

ing the new alkyd as compared to formulations based on current high quality alkyd resins:

Tukon hardness — 50-100% greater (baking temperatures of 200-300 F.)

Gloss retention—150% better (after 16-hr. exposure at 400 F.)

Whiteness retention — 100% higher (on Photovolt comparator after 16-hr. exposure at 400 F.)

Substantially reduced blistering from immersion in hot household soaps and syndets.—
Rohm & Haas Co., Philadelphia 5, Pa. 146C

#### Acetate Yarn

High strength with low stretch; for industrial belting.

Offering many benefits to industries which use fire hose, or where machines are belt-driven or where materials are belt-conveyed is Fortisan-36. This highly saponified acetate yarn has strength, (better than 8 gm./denier) low stretch and dimensional stability.

Specifically, here's what Fortisan's virtues mean:

· Power Belting strength permits smaller belts and smaller pulleys and therefore lower over-all costs for machinery designers. Dimensional stability insures the constant speed for V-belt driven machinery necessary to uniform production quality. Since it will be possible, because of higher strength and modulus, to use fewer plies of fabric to reinforce flat power transmission belts, the belts should cost less. Power utilization will be more efficient since flexural forces of the belt working against the driving power are less. Absence of flexural forces insures longer life for the belt as well.

• Firehose — High strength to weight ratio gives a fire hose, built with Fortisan-36 yarn in the filling, that's light in weight, flexible, yet strong and pressure resistant. And Fortisan is not thermoplastic, will not fuse when heated.

Conveyor Belting—Expansion of uses in which fabric-reinforced belts can be used,
 e.g. replacement of some con-

veyor belts now reinforced with steel.—Celanese Corp. of America, New York 16, N. Y. 148A



#### Fortified Rubber

Defies salt and volts.

Bolstered by a chemical additive, a modified butyl rubber is succeeding as a high voltage insulator (15 kv. and above) in all kinds of weather—weather like the salt-spray-fog simulated in the testing chamber pictured above. The secret: elimination, via the additive, of the phenomenon called "tracking" (the formation of free, corrosive carbon which causes deterioration of insulation).

The high voltage transformer you see in the photo is insulated with Hy-Bute/60 rubber and has just survived 1,400 hr. at high voltage in the chamber. This rubber's new-found strength as an insulator means elimination of oil-filled metal casings, porcelain bushings and gaskets; it will yield a smaller, lighter transformer that lasts longer, needs less maintenance. Epoxy, polyester, phenolic plastics, too, respond to this additive, have a chance of cracking electrical applications long barred to them, such as breakers, switches or ignition systems. — General Electric Co., Schenectady 5, N. Y. 148B

#### Polyglycol Ethers

Usage varies from dust abatement to absorption.

New dimethyl ethers of four ethylene glycols are useful as commercial solvents and reaction media. They're tradenamed E-121 (ethylene glycol), E-141 (diethylene glycol), E-161 (triethylene glycol) and E-181 (tetraethylene glycol). Here are some possible applications:

• Dust abatement—E-181, in quantities as low as 1% by weight, controls dusting on such materials as solid inorganic alkalis. The ether neither reacts with nor dissolves the dusty composition and does not affect the material's solubility.

• CO, absorbent—E-181 removes CO<sub>2</sub> from gas mixtures used for ammonia synthesis. This ether has about four times the capacity for CO<sub>2</sub> absorption as does water, the heat of solution is about the same as water's, and the hydrogen absorption coefficient is about the same as water's. Regeneration of the ether is simple.

Cellulose derivate solvent
 E-121, mixed with water, produces a clear solution of cellulose acetate.

• Detergent constituent—
Reacting any of these ethers
with an alkali metal salt of a
formaldehyde naphthalene sulfonic acid and an inorganic alkali salt gives a detergent
which can be dried and packaged in flake powder or beaded
form.—Ansul Chemical Co.,
Marinette, Wis. 148C

#### **Barrier Coating**

Helps contain products not packageable before in polyethylene containers.

Increasing polyethylene's ability to successfully contain materials means more competition for the metal tube industry as well as increased outlets for the plastic. And therein lies the significance of the development of an internal barrier coating that enables polyethylene to package extended-shelf-life products, such as toothpastes, shave creams and cosmetics, without odor or flavor dissipation.

Without this coating certain essential oils permeate the plastic walls causing flavor and odor loss; some petrolatum based or plasticized hydrocarbon based materials bleed through the



### CHEMICAL ENGINE

PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

# NEWS

## Tower packing of ALATHON® improves holdup in diffusional operations

Now, lightweight "Alathon" polyethylene resin increases the efficiency of tower packing. The "Tellerette" was designed as a packing based on the principle of holdup of liquid in interstitial spaces. Strong and flexible "Tellerettes" of "Alathon" reduce the height of packed bed necessary for given separations and permit the use of a smaller-



These "Tellerette" packings for diffusional operations are extruded, automatically coiled and rosetted of "Alathon" by Robert S. Crane Associates, Columbus, Ohio.

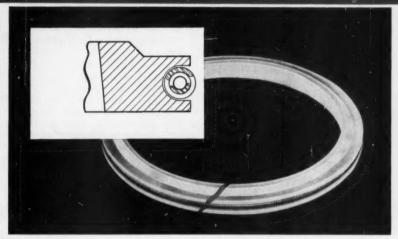
diameter column for the same operation. In addition, "Tellerettes" made of "Alathon" resist most common chemicals and give longer service life.

### Porous filters of TEFLON® for gases and liquids



A porous form of Du Pont "Teflon" is used in disk and cup filters which can filter particles larger than 3 microns out of liquids, larger than one-tenth micron out of gases.

The filters can be used for commercial acids, caustic and organic solvents, including fuming nitric acid, aqua regia and hydrogen peroxide. They will handle all reagents and can be chemically cleaned and sterilized. The properties of "Teflon" demonstrated in this application may be of value in your business. (Filters manufactured by Porous Plastic Filter Company, Inc., Glen Cove, N.Y.)



These scraper rings are made of Du Pont "Teflon" tetrafluoroethylene resin. Note the spring running around the ring. Detail of the spring and grooved ring section is shown in cutaway diagram. (Scraper made by Shamban Engineering Company, Culver City, California.)

### Scraper ring of TEFLON® absorbs wear, protects O-ring seals

Low friction, toughness, chemical inertness important features of ring.

Scraper rings of Du Pont "Teflon" tetrafluoroethylene resin keep dirt and other foreign matter away from vital O-ring seals in hydraulic retracting cylinders and actuators, control valves and pneumatic equipment.

The scraper rings are spring-loaded to maintain firm contact on the rod and absorb much of the wear that normally shortens the service life of Orings. The low friction, toughness and chemical inertness of "Teflon" enable

these rings to give perfect service at operating temperatures encountered.

"Teflon" is inert to all chemicals except molten alkali metals and fluorine at elevated temperatures and pressure. It retains its toughness and flexibility at temperatures as low as —450°E, can give continuous service in many uses up to 500°E

You can get complete property data about this engineering material by clipping and mailing the coupon.

#### NEED MORE INFORMATION?

CLIP THE COUPON for additional data on the properties and applications of these Du Pont engineering materials.

"Tetlon," "Aletbon,"
"Zytel" and "Lucise" are registered trade-marks of E. 1.
du Pont de Nemours & Co.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 251, Du Pont Building, Wilmington 98, Delaware In Canada: Du Pont Company of Canada Limited, P.O. Box 660, Montreal, Quebec.

Please send me more information on the Du Pont engineering materials checked: 

"Teflon"\* tetrafluoroethylene resin; 

"Alathon"\* polyethylene resin; 

"Zytel"\* nylon resin; 

"Lucite"\* acrylic resin. 
I am interested in evaluating these materials for.

NAME	
COMPANY	POSITION
STREET	
CITY	STATE

walls causing oily staining and container collapse; or oxygen diffuses through the plastic and may cause rancidity and fungus growth.

Now that much of the problem is licked, poly packagers will be wooing some big container-consuming markets: toothpastes (500 million containers yearly); shave creams (75 million packages a year); medicinals (200 million a year); and cosmetics (90 million units a year). — Bradley Container Corp., Maynard, Mass. 148D

#### Rubber-Sized Fiber

More compressible, more resilient.

Precipitating a Hycar-type synthetic rubber directly on paper fibers (other rubbers can only be coated on the surface of paper) produces a vulcanized fiber well suited for abrasion-resistant uses. Type RS-10H rubber-sized fiber's friction coefficient is 30-50% higher than that of standard vulcanized fiber.

The new vulcanized fiber has several advantages in gasketing applications: it's 70% more compressible, 69% more resilient (although tensile and compressive strengths are lower); both its rubber and fiber components are practically unaffected by oil; and its chemical resistance is improved. — National Vulcanized Fibre Co., Wilmington, Del. 150A

#### BRIEFS

Unique plasticizer, Esterflex B-1, contains both polar and nonpolar groups, combines advantages of several classes of plasticizers into one general purpose product. Esterflex B-1 has high solvating properties particularly for polyvinyl chloride compounds.

—Swift & Co., Hammond, Ind.

Conductive floor waxes VC-26 and H-22 are the first such waxes to gain acceptance of the Underwriters' Laboratories for application wherever there is danger of static electricity and conductive floors have been installed. Conventional waxes are insulators, increase chances of an explosion.—Huntington Laboratories, Huntington, Ind.

Acid-stable penicillins, V-Cillin (Lillv) and Penicillin V (Wyeth), give higher blood levels by oral dosage than does penicillin G. Both products are an acid form of phenoxymethyl penicillin which, because it is highly stable in stomach acids, is more available for absorption by the bloodstream.—Eli Lilly and Co., Indianapolis 6, Ind. 150D

A one-part epoxy-based adhesive permits for the first time, it's claimed, the economical use of adhesive bonding in mass production joining of metals, rigid plastics. Bondmaster M620 needs no mixing of separate resin and hardener and contains a thixotropic additive which prevents the adhesive from dripping or running before or during the cure.—Rubber & Asbestos Corp., Bloomfield, N. J.

A raw material for chemicals—that's how Alcoa hopefully looks upon the tar derived from the carbonization of lignite to produce electric power for its plants. A research program has uncovered valuable chemical compounds in the tar and is working on a way to recover them.—Aluminum Co. of America, Pittsburgh 19, Pa. 150F

Azelaic-based lubricant esters,
Emolein 2957 (isooctyl ester)
and Emolein 2958 (di-2-ethylhexyl ester), are now available on a commercial basis. Some major advantages
claimed: outstanding viscosity-temperature relationships,
high flash and fire value, excellent additive response.—
Emery Industries, Inc., Cincinnati 2, Ohio. 150G

Fiber-reinforced Teflon sheet material, called Duroid 5600, offers greater resistance to distortion in cold flow and extrusion. MD stiffness is 140,000 psi.; deformation under load, 2% at 1,200 psi. and 3% at 2,000 psi.; heat distortion temperature, 500 F. plus.—Rogers Corp., Rogers, Conn.

Useful to plastics and finishes fields are pyromellitic acid (PMA) and pyromellitic dianhydride (PMDA). Addition of PMA to alkyd formulations yields improved film properties. Epoxy resins cured with PMDA have heat distortion temperatures above 250 C. and superior chemical resistance.—E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 150I

Purest dimethyl alkyl tertiary amines ever produced are available in quantity. Undistilled grade has at least 80% tertiary amine, the distilled grade, at least 92%. Tertiary amines are used as catalysts in isocyanate foam, as lube oil additives, as activators of thiazole and thiuram in rubber production.—Armour and Co., Chicago 9, Ill. 150J

Zinc-rich paint electrochemically protects iron and steel in much the same manner as does galvanizing. Successful in England for several years, zinc-rich paint is, however, new to the U.S. It's pigmented 100% with zinc dust and contains plasticized polystyrene and chlorinated rubber as the vehicle.—New Jersey Zinc Co., New York 7, N. Y. 150K

For More Information ...



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Postcard inside the back cover.

#### **New South American Plant**



TRI-SURE S/A

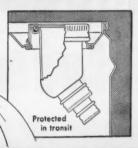


The new Tri-Sure subsidiary, Tri-Sure S/A Industria e Comércio, Sao Paulo, Brazil, supplies a complete line of closures for drums and pails.

#### **Tri-Sure Reversible Spout**

The new Tri-Sure reversible assembly makes it possible for pail manufacturers to offer a utility container that their customers will demand.





#### Tri-Sure Lithographed Fittings



Lithography protects fittings, adds life and color and provides a base for private designs on the caps.

## Tri-Sure progress is your protection

when you ship drums, pails or cans

These new Tri-Sure\* products, all introduced in the past 12 months, are the outgrowth of research and tests that are constantly being made to maintain the utmost efficiency in Tri-Sure Closures and Service Tools.

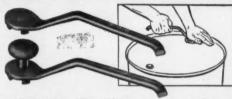
35 Years' continuing search for improvements has provided important benefits to every user of Tri-Sure Products because drums and pails are protected by closures that have the most advanced features, provide maximum security, and are the last word in ease of operation.

Now more than ever, it will pay you to specify *Tri-Sure Closures* on every order for drums, pails or cans—and to consult *Tri-Sure* sales engineers whenever you have a closure problem.

\*The "Tri-Sure" Trademark is a mark of reliability backed by over 35 years serving industry.



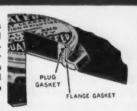
#### **Tri-Sure Offset Plug Wrenches**



Designed for 2" and ¾" die cast and steel plugs. Hand rest enables head to be held down firmly while handle is turned. Offset handle keeps knuckles free of drum chime.

#### **Tri-Sure Heat-Resistant Gaskets**

Standard Buna Gaskets for Tri-Sure Flanges and Plugs are further improved and have longer life. The new Hypalon Gaskets give improved gasketing qualities to chemical products.



AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Tri-Sure Products Limited, St. Catharines, Ontario, Canada

Tri-Sure S/A Indústria e Comércio, Sao Paulo, Brazil

B. Van Leer N. V., Stadhouderskade 6, Amsterdam, Holland

Van Leer Industries, Ltd., Seymour House, 17 Waterloo Place, Pall Mall S.W. 1. London, England

# "Impossible" jobs like for new Versamid\*



Let 'em sweat...paint right over moisture and rust, and two coats outlast seven of conventional paints! Here's the perfect finish for oil tanks, barges, derricks and other surfaces hard to prepare for painting. In laboratory tests, only Versamid-epoxy finishes licked all three of paint's worst enemies ... alkalies, acids and impact.

Tank trucks and special purpose railroad cars need "armor plate" like this to stay new-looking longer in severe climates. Cars, outboard motors, tractors and farm machinery, defy the ravages of water, wind and weather, thanks to the extreme hardness of paints formulated with an alloy of epoxy resins and General Mills Versamids.

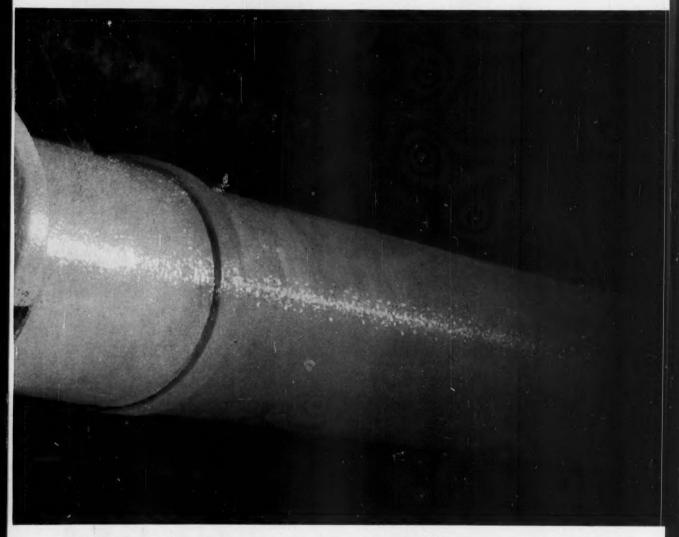


For more information, write for Technical Bulletin 11-D. Tell us as much as possible about your needs or applications so we can be of maximum service.

\*Investigate Versamids...

the versatile polyamide resins made only by...

# this are routine -epoxy alloy paints!



For industrial maintenance work, these paints offer unique qualities that mean important savings. Colorful, almost indestructible coatings can be brushed or sprayed on machine tools, cement or wooden floors, or walls of any material. Resistance to fumes and most solvents make Versamid-epoxy paints ideal for industry.

Use brush, roller or spray gun...air dry or bake the finish. Does not need oxygen to cure. Some formulations are as hard after air-drying as conventional paints after baking. (Please note that General Mills does not manufacture paints . . . only the Versamid polyamide resins that make these remarkable new finishes possible.)

CHEMICAL DIVISION of General Mills

KANKAKEE. ILLINOIS

UNBURNED GAS
LOSS

TOTAL AIR - PER CENT
The new Bailey Oxygen-Combustibles Analyzer-Recorder (shown at right) provides a continuous two-in-one check of combustion efficiency by recording both oxygen and combustibles in flue gas. As shown by above charl, both measurements are needed to determine combustion

# BAILEY announces ... New 2 in 1 way to measure Combustion Efficiency

The new Bailey Oxygen-Combustibles Analyzer-Recorder gives you a continuing double check on combustion economy. It's fast response measures and records:

- 1. Excess air-regardless of the fuel or combinations of fuels being burned.
- 2. The mixing efficiency of your fuel-burning equipment—by indicating the amount of combustibles in your flue gas, resulting from incomplete mixing of fuel and air.

Combustion efficiency depends upon fuel-air ratio. Too much fuel can be even more costly than too much air. And because of the interdependence of these two factors, no control that measures only one of them can give you complete protection.

Now, for the first time, you can check both with a single fast acting instrument, using the new Bailey Oxygen-Combustibles Analyzer-Recorder for industrial furnaces, kilns, heaters and boilers.

Fuel economy improves as excess air is reduced—until unburned fuel begins to show up in the flue gas.
When this happens, combustion efficiency drops off

sharply if there are further decreases in the air-fuel ratio. That's why combustion gases must be analyzed for both oxygen and combustibles to get a true indication of efficiency—and that is why Bailey coordinates both measurements on the same chart, to show when excess air may be reduced safely without danger of greater losses from unburned gases.

The Bailey Oxygen-Combustibles Analyzer is an approved combustion safeguard.

Ask your local Bailey engineer for suggestions on application. Equipment details in Product Specifications E65-1 and E12-5,



#### BAILEY METER COMPANY

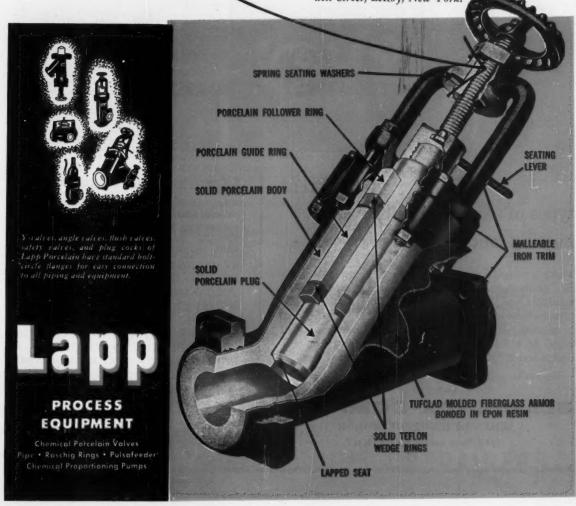
1054 IVANHOE ROAD . CLEVELAND 10, OHIO

INSTRUMENTS AND CONTROLS

# Easy working and long life in chemical atmospheres ... for the Lapp Valve

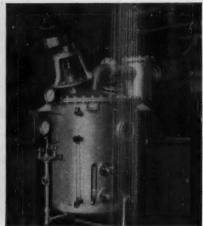
Non-ferrous working parts in the Lapp Valve eliminate freeze-ups from scales of corrosion. Threaded stud, yoke bushing and nuts, and plug cap are all brass or bronze, which keep the valve smoothly operative in all but the most unusual conditions of chemical atmosphere. Flange, yoke and gland are of high strength malleable or ductile iron, and are protected with baked-on Epon-base acid-proof paint. Flanges are permanently bonded to porcelain or armor with acid-proof resin cement.

Write for bulletin with complete description, characteristics, and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 422 Wendell Street, LeRoy, New York.



Chemicals, resins, grease, foods, pharmaceuticals, cosmetics, confectionery, dental and shaving creams, detergents





#### THE RIGHT KETTLE FOR EVERY PROCESS NEED...







with different

#### types of agitators and mixers, heating methods, controls

There is a right kettle for every processing requirement. End product, capacity desired, heat source and method, agitation and drive, and other factors determine the type and size of kettle. After about 50 years of experience in process engineering, Blaw-Knox engineers are prepared to build the kettle to your design or engineer, design and construct a kettle to fit your operations.

We invite your inquiries.

#### A Complete Process Equipment Service

Kettles of every description constitute but one phase of Blaw-Knox Process Equipment design, engineering and fabrication service for the chemical, food, pharmaceutical, plastic and resin, petroleum, rubber and other industries: EVAPORATION • DRYING • FLAKING MIXING • IMPREGNATING • REACTION VULCANIZING • SOLVENT RECOVERY SOLVENT EXTRACTION • STERILIZING CRYSTALLIZATION • DISTILLATION POLYMERIZATION • GAS CLEANING GAS ABSORPTION • VAPORIZATION CONDENSATION • HEAT TRANSFER LOW AND HIGH PRESSURE PROCESSING

#### **BLAW-KNOX COMPANY**

BUFLOVAK EQUIPMENT DIVISION

1551 Fillmore Avenue, Buffalo 11, N.Y.

Makers of process equipment engineered for any pressure, temperature, capacity, reaction



# USE STRAINERS? USE YARWAYS



Use pipeline strainers in your plant? If so, you've plenty of reasons for using YARWAY Fine Screen Strainers.

Some of the reasons are these:

- Available in iron or steel with rust-resistant finish, also bronze, stainless steel and aluminum.
- Dutch weave Monel woven wire screens have high mechanical strength, extra fine straining service. Also perforated bronze, monel or stainless steel.
- Easy to remove screen caps with straight threads to assure proper alignment of screen.
- 10 standard sizes from ¼" to 3". Larger sizes to order.
   Also flanged and socket-weld connections.
- Stocked and sold by over 300 industrial distributors in the United States, Canada and abroad.

Write today for Yarway Strainer Bulletin S-204, and name of nearest distributor.

YARNALL-WARING COMPANY

137 Mermaid Avenue, Philadelphia 18, Pa.



#### SCREEN EASILY REMOVED

Unscrew cap and screen comes out with it. When replacing, put screen in cap, then screw cap into body. Straight threads assure correct alignment, no screen distortion. Cap is tapped for pipe plug or blow-off line.



FINE SCREEN STRAINERS



WRITE FOR BULLETIN 1125-B

803 Nottingham Way, Trenton 2, New Jersey

There's more to buying

#### PHENOL

than meets the eye!

• You get unseen benefits in specifying RCI PHENOL.

The very fact that Reichhold is one of the world's most rapidly growing chemical firms provides you with a very real advantage in doing business with us.. We're proud of our position. To continue such development, we know we've got to give outstanding service. We've equipped ourselves to do just that... with a huge manufacturing set-up, well-stocked warehouses a short distance from any part of the U. S., and expert technical assistance available from our many plants and sales offices.

As for performance, RCI PHENOL couldn't be better. The outstanding reputation Reichhold enjoys as a quality producer spells satisfaction for you.

If you make . . . plastics, plasticizers, synthetic resins, insecticides, disinfectants, explosives, dyes, lubricating oil additives or pharmaceuticals, investigate RCI Phenol (shipped in drums and tank cars). Write us for further details.



Creative Chemistry . . .

Your Partner
in Progress

Phenol starts its trip to a customer from a siding at RCI's Tuscaloosa plant where it is being loaded into a tank car.

### REICHHOLD

Synthetic Resins • Chemical Colors • Industrial Adhesives • Plasticizers

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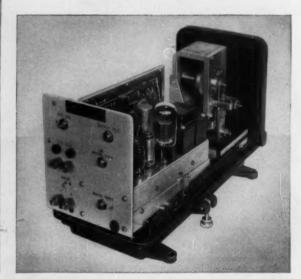
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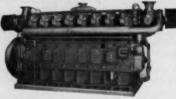
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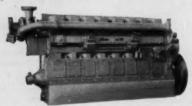
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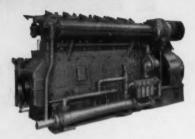


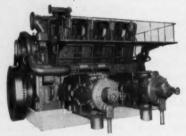
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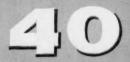




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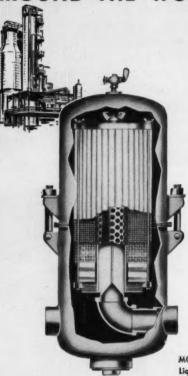
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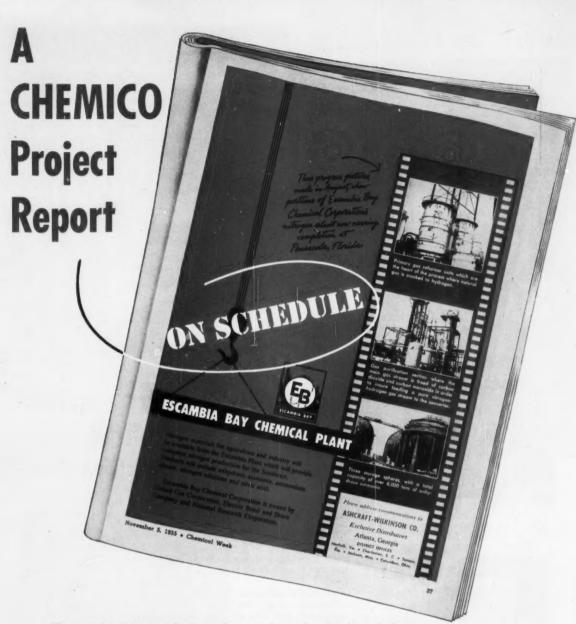
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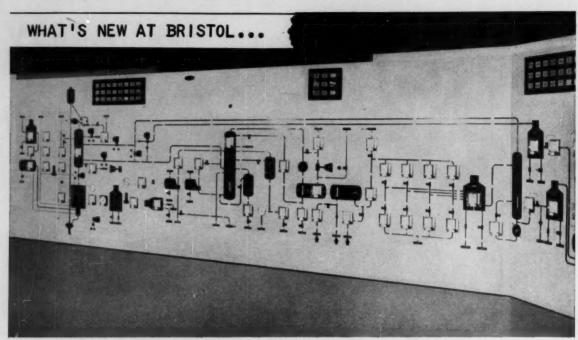
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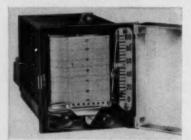
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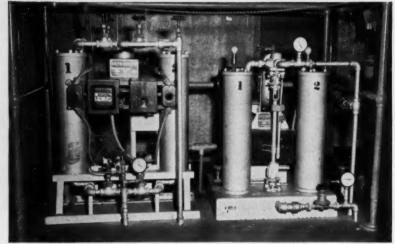


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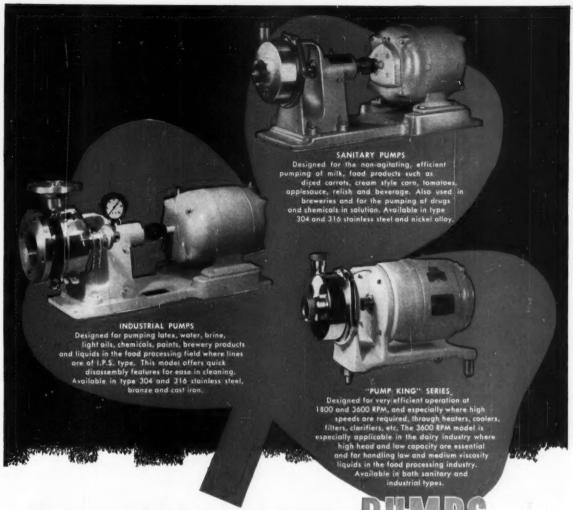
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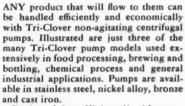
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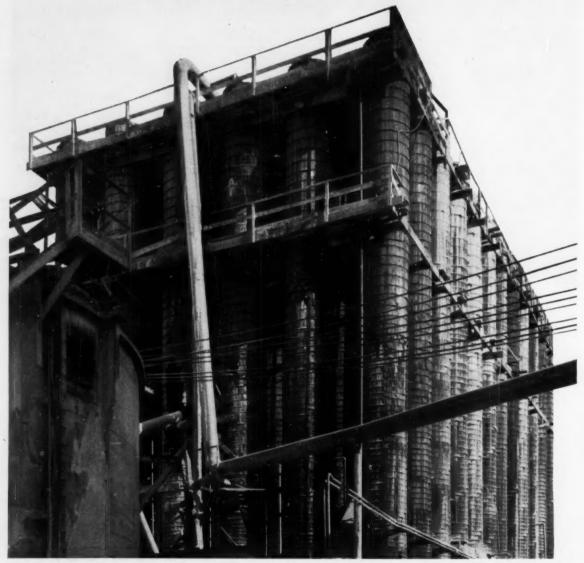




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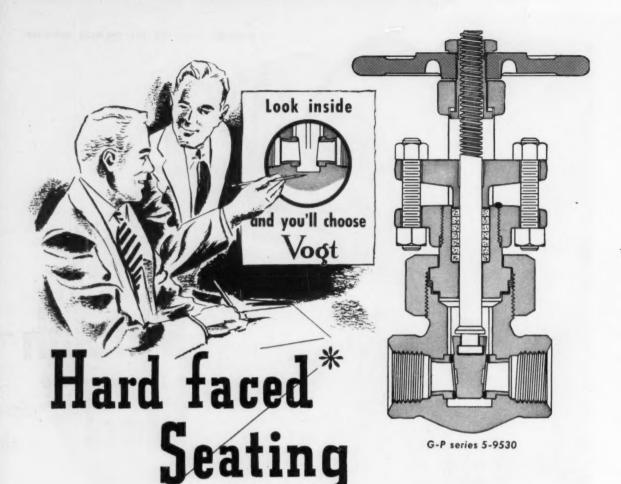
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#### Chemical Engineering

JANUARY 1956

Technology in the Year Ahead

In this 33rd Amual Review and
Forecast CE's editors evaluate the significant trends of the part year and their effect on your future.

W HAT'S ahead for the chemical engineer in 1956?

Chemical engineers, as well as political party leaders, want to know what this year holds in store.

Predicting the future of chemical engineering, fortunately, is less hazardous than trying to forecast the results of the 1956 political campaigns. Our best bet is to take an over-all look at recent technological developments and the basic factors which underlie them. We can then safely project the most significant trends into the foreseeable future.

What are the basic factors which account for recent advances in technology, factors which will help shape our future?

• One factor which is becoming increasingly important from year to year is the gradual depletion of our richest, most readily available natural resources. Rapidly growing interest in nuclear and solar energy, shifting of raw material bases for ammonia and cellulose pulp, recovery and reuse of waste products—all emphasize this factor.

 Another inescapable trend is the rising cost of labor. This trend, coupled with the growing scarcity of low-cost raw materials, affects production costs all down the line. The chemical engineer will help keep costs under control—not so much with more automation, as commonly supposed—as by the use of scientifically derived cost standards and by the development of new and improved processes which employ cheaper raw materials, improved processing techniques and better materials of construction.

 As consumer purchasing power grows and leisure time increases, living standards will continue to climb. To meet the demands of specific markets, the chemical engineer will be developing tailor-made varieties of synthetic resins, fibers and motor fuels.

These trends are reflected in another one important to all of us interested in the future—the continuing rise in the ratio of technical to nontechnical workers in the manufacturing industries. This condition demands that today's engineers boost their effectiveness by mastering the use of such tools as linear programming and high-speed computers, and that today's educators redesign their engineering curricula to meet industry's future needs.

Let's see, in the next 15 pages, how recent developments illustrate these trends.



# based on today's trends in Material Resources

Many of the chemical engineer's problems are intimately associated with the cost, availability, quality and characteristics of natural resources and other raw materials.

Today's civilization consumes material resources at staggering rates. And the rate of consumption continues to increase.

These resources, for the most part, are nonrenewable. The most readily accessible, highest-grade deposits of certain minerals are already facing exhaustion. Others will be depleted within another generation. Their costs are climbing with the increased difficulties and distances involved in finding, extracting and transporting them.

The chemical engineer, therefore, must find ways to free his operations from dependence on materials of low cost and high quality. He must be ready to shift to different materials whenever economic conditions dictate.

Many of the technological advances made during the past year reflect such conditions. These same conditions will carry into 1956 and beyond, defining many new problems requiring the chemical engineer's best efforts.

#### **Nuclear Power Prospects Brighter**

Current activity points toward competitive power from the atom within a very few years; taming the fusion reaction offers long-range benefits, challenging engineering problems.

While costs of fossil fuels continue to rise, powerplant efficiencies approach a plateau and undeveloped hydro power sources grow scarcer, prospects of competitive nuclear power in the not-very-distant future are becoming brighter.

The roster of concerns that have formed nuclear divisions or subsidiaries is now surprisingly large. Most active, of course, are companies in the utility business and those who believe they can serve the utilities.

Construction started last year on the first fullscale nuclear power plant, the 60,000-kw. AEC-Duquesne Light plant at Shippingport, Pa. In addition, four groups of interested utilities have made proposals under AEC's "Power Demonstration Reactor Program," in which full-scale plants are to be built with a small proportion of government aid. Consolidated Edison, of New York, has also sought authorization to build a large plant.

These six power reactors contemplate a total electrical output of some 700,000 kw. and an investment of \$250 million, of which about 15% would be government funds. They include four of the five reactor types in the AEC's own five-year reactor development program—the pressurized-water, boiling-water, sodium-graphite and fast-breeder reactors. The fifth type, the homogeneous reactor, has been proposed for utility use by Pennsylvania Power & Light in cooperation with Westinghouse.

AEC's program has recently been amplified to include hydrocarbon-moderated and liquid-metal-fueled reactors. AEC already has some 16 research reactors, and those being planned or built by industry, colleges and research organizations total about 15 more.

Several chemical concerns, as well as the Bureau of Mines, have discovered a possible interest in direct use of process heat from nuclear reactions. Estimates of the cost of nuclear reactor heat run as low as 10¢ per million Btu., compared with a fair average of 25¢ for heat from fossil fuels. Such a low cost is not realistic at present—except perhaps as a byproduct of plutonium production—but it's not impossible for the future. Another selling point in favor of nuclear heat is the probability that it can be had at any desired temperature level, provided only that the chemical engineer can find materials to contain it.

Even more challenging are the possibilities of capturing the energy released by fusion reactions of the H-bomb type. Official confirmation was given last year that AEC is actively studying these possibilities. Owing to the solar temperatures required for such reactions, the problem will probably yield to solution only after many years, if at all.

One of the big attractions of fusion-reaction energy would be the fact that there would be no radioactive wastes to dispose of—a problem which will demand lots of attention from the chemical engineer before very long if the currently used fission reactions are to make any real headway in power generation.

Another source of energy—the sun itself—got a lot of attention last year. Headliner was the Bell solar battery, whose efficiency now stands at 11%. This device, however, is still too expensive to compete with conventional energy sources, despite the fact that it produces electricity directly.

For chemical processing, the solar furnace offers more promise. Properly designed solar furnaces can achieve temperatures exceeding that of the carbon arc. French engineers have developed centrifugal furnaces, heated by concentrated solar radiation, in which they have produced pure zirconium oxide.

Although the prospects for economically harnessing solar energy are still dim, this field has its share of confirmed optimists. Nearly 1,000 of them met in two related conferences recently to discuss the problems involved. Such meetings will make for more rapid progress in the future.

#### Hydrogen Upgrades Petroleum

Forced to use lower-grade crudes, more refiners will be turning to cheap hydrogen from catalytic reformers as an effective, versatile treating agent.

What effects are increasing demands for petroleum products producing?

For one thing, more crudes with high sulfur content must be used by refiners. Substitution of a high-sulfur crude for a low-sulfur crude degrades product quality and gives rise to corrosion prob-

Chemical engineers are solving these problems neatly by taking advantage of the ready availability of cheap hydrogen from newly installed catalytic reformers. Hydrogen treating seems to be extremely versatile, able to upgrade most any petroleum fraction, even crude feedstocks. All that's needed is the right combination of temperature, pressure, catalyst and hydrogen concentration.

While most hydrogen treating processes operate on a specific distillate fraction, the Gulf HDS process, announced last year, desulfurizes crude oil. Gulf feels that sweetening the lighter fractions is easy enough; the real problem is to upgrade heavy fractions. Until now, relatively high pressures and, therefore, expensive processing methods, have been necessary to hydrogenate heavy stocks. Gulf uses pressures under 1,000 psi., compared with pressures in the 3,000-10,000 psi. range.

Whether the process engineer favors the Gulf concept or one of the other recently announced hydrogen treating processes, he'll no doubt have plenty of hydrogen available. At the end of 1955 catalytic reformers were giving off some 500 million cu. ft. of hydrogen every day. By 1965 the figure

will probably be 1,250 million.

The long-range effects of increasing demands for liquid fuels will provide the chemical engineer with more challenging problems. He will be called on to develop economical processes for obtaining liquid fuels from shale oil, tar sands, gilsonite and coal. Last year saw significant happenings in all four fields. The development most likely to reach commercial success on this continent in the near future is based on the coking of gilsonite, with the production of catalytically reformed gasoline from the coker overhead. American Gilsonite Co. is building a \$10-million plant in Colorado to process crushed

gilsonite hydraulically transported from a mine in Utah 80 miles away.

#### Ammonia Declares Independence

New sources of hydrogen will give greater freedom in selection of process and location; coke-oven gas, partial combustion of oil and coal steal the spotlight from natural gas.

Shifting raw-material bases are occupying the chemical engineer's attention in the manufacture of synthetic ammonia. Several new hydrogen sources are now on the scene, providing the engineer with a much greater degree of independence in selection of process scheme and plant site than ever before.

Since World War II, methane from the natural gas fields of California, Texas and the lower Mississippi Valley has served as the source of hydrogen for the majority of ammonia plants-principally by reforming with steam, more recently by partial oxidation with oxygen. Other plants-less important in terms of production capacity-have used byproduct hydrogen from electrolytic causticchlorine operations.

Two of the new hydrogen sources are logical extensions of the partial oxidation technique-using coal or heavy fuel oil instead of natural gas. Du Pont is experimenting at its venerable Belle, W. Va., ammonia plant with the partial oxidation of pulverized coal in the presence of steam. And at least two plants now being built will make their synthesis gas from a heavy fuel oil, such as Bunker C.

Chemical engineers have also begun to tap other sources of byproduct hydrogen to make ammonia. One of the most interesting of these developments centers around the use of coke-oven gas. Ketona Chemical Co.'s plant has already started production, a U. S. Steel plant is under construction, and others are being considered.

The economic situation which led Ketona to build its new COG-based ammonia plant near Birmingham is worthy of comment. Until the advent of pipeline natural gas in the Birmingham area, cokeoven gas was the premium fuel, too valuable for ammonia production. When natural gas took over the premium fuel market the economic picture was reversed, making surplus COG a favorable hydrogen source for ammonia, even with natural gas now available.

Another big source of byproduct hydrogen now being put to use in increasing quantities for ammonia production is the off-gas from petroleum refinery catalytic reforming operations. Reformer off-gas is quite rich in hydrogen, averaging about 85%. This situation is enticing several petroleum refiners into the ranks of ammonia producers.

National Distillers' new plant at Tuscola, Ill., is based on byproduct hydrogen from still another source-the thermal cracking of ethane for the

production of ethylene.

There is no obvious pattern shaping up right now which would indicate the long-term future source of ammonia synthesis gas. Local conditions will no doubt influence each company's decision for several years to come, giving the process evaluation engineer plenty to do. But many engineers in the industry look to the perfection of coal gasification as the ultimate answer.

#### Sulfuric Acid Recovery Expanding

New processes for recovering clean acid from petroleum refinery sludges offer dual benefits of sulfur conservation and pollution control, put fresh life into an old business.

Although the ill wind of the sulfur-sulfuric acid shortage of 1949-51 made few friends while it blew, it did blow some good by focusing attention on the need for sulfur conservation. Also, at about the same time as the sulfur shortage, pressures were beginning to build up for better control by industry of air and water pollution.

The combined results of these two influences are evident in several developments of the past five years, such as the building of numerous units for recovery of sulfur from H<sub>2</sub>S, plants for processing low-grade deposits and improved scrubbers for reducing the emission of SO<sub>2</sub> from acid plants.

More recently, another facet of this picture has come into the limelight—recovery of sulfuric acid from petroleum refinery sludges. There has been something like a threefold expansion in sludge-acid recovery operations in the past five years. And the fine hand of the chemical engineer is much in evidence in the new techniques being put to use.

Chemical Construction Corp., working with Consolidated Chemical Industries of Houston, has developed a simplified process which is now used in four Consolidated plants. The two newest ones are both 400-ton-per-day plants which have been rather widely publicized.

Essentially, they are conventional contact sulfuric acid plants in which a sludge, or several sludges blended to desired composition and consistency, are burned like so much fuel oil or molten sulfur. If desired, the plants can burn sulfur also. If the sludge composition happens to be too lean in hydrocarbon, auxiliary fuel can be burned in the same sludge burner. The process is adaptable to almost any sludge, but is best suited to large plants handling a variety of blendable sludges. This is the way Consolidated operates, securing its sludges from a variety of sources and different processes.

Two other new developments are improved versions of the old Chemico coking-type plant. The Miley process, just put into operation by L. Sonneborn Sons at Petrolia, Pa., charges the sludge into a ribbon mixer, where it is mixed with hot, recycling coke. The mixture is elevated, then dropped through a heat exchanger, where it is heated indirectly by hot gases from a furnace. The cracked hydrocarbons deposit on the coke, while the SO<sub>2</sub> comes off and passes to the contact plant. The process is effective with any pumpable and cokable sludge ranging from as little as 30% to as much as 75% acid.

Monsanto's process is similar in principle, though

it differs in equipment design. It covers substantially the same range of sludge compositions; its principal difference is the use of a vertical kiln, as opposed to the horizontal rotary kiln of the old Chemico process. Monsanto's first unit, at Tide Water Associated's Avon, Calif., refinery, ran into difficulties, which have now apparently been overcome. A second unit was installed recently at Gulf's refinery at Port Arthur, Tex. \*

A still newer process, to be tried out shortly, has been developed by M. W. Kellogg for use with alkylation sludges of 80% or more acid content. Nothing has been announced publicly, but from a recently issued patent the process appears to involve low-temperature crystallization in which the acid content is brought down as small, relatively pure crystals by suspension in a cold hydrocarbon medium, e.g., propane.

These developments all add up to this—that even a stable, unglamorous industry like sulfur-sulfuric acid offers many challenging problems to the chemical engineer.

#### Wet-Process Rivals Furnace Acid

New developments in the use of wet-process phosphoric acid promise increasing competition with electric-furnace phosphoric acid in some of the latter's entrenched positions.

Another unglamorous oldtimer — wet-process phosphoric acid—is figuring in recent shifting of raw material bases.

Couple of years ago, the big news was extraction of uranium from wet-process phosphoric acid. Later developments aren't as spectacular, but they, too, strengthen wet-process acid's position vs. electric-furnace phosphoric acid.

Until recently, wet-process acid hadn't been used successfully to make diammonium phosphate fertilizer or feed-grade dicalcium phosphate. Higherpurity furnace acid monopolized these fields.

Now, however, Dorr-Oliver has come out with a DAP process which permits use of wet-process acid. It's being used in a new plant at Joplin, Mo., by Missouri Farmers Association.

Most attempts to use wet-process acid have met with failure because the acid's metallic impurities are precipitated as phosphates and hydroxides when reacted with ammonia, interfering with filtration of the DAP slurry. The new process eliminates the filtration step by using the heat of reaction to drive off most of the water in the reaction mix. A 20% slurry comes out of the reactor system, going directly to granulation and drying steps.

Tennessee Valley Authority has approached the same problem in a different way. TVA first removes the metallic ions as filterable phosphates at a pH of 5. Then the acid is reacted with ammonia in a vacuum crystallizer, and the slurry is handled by a centrifugal.

Texas City Chemicals is making 160 tons per day of feed-grade dicalcium phosphate with wet-process acid. In order to do so, chemical engineers had to find how to make an essentially fluorine-free product from an acid containing appreciable quantities of fluorine.

The new process removes fluorine in two stages. Part of the fluorine is removed by reacting the acid with a saturated brine solution. The rest of it comes down with 40 tons per day of fertilizer-grade DCP by reaction with a deficiency of lime. The fluorine-free solution of calcium phosphate from this step then reacts with more lime to produce the feed-grade product.

#### Ion Exchange Ready for New Jobs

Ability to recover metallic ions from dilute solutions, such as in uranium hydrometallurgy, underlies current interest in ion exchange; continuous processes are on the way.

As we become more and more dependent on lowgrade ores for such critical materials as copper, cobalt, nickel and uranium, hydrometallurgical processes will be more widely used. And ready to take its place in these processes is the chemical engineer's pet, ion exchange.

Ion exchange's adherents feel that it will fill a definite need, since it is particularly adept at picking metals out of the very dilute extracts which characterize hydrometallurgical processes.

Ion exchange got a major endorsement last year with the disclosure at Geneva of its important role in uranium hydrometallurgy. Uranium ore is leached with sulfuric acid; the filtered extract is passed through an exchange resin which selectively adsorbs the dissolved uranium.

In fact, much of the development work on continuous ion exchange is associated with uranium recovery. AEC is pilot-planting at Grand Junction, Colo., two of the most promising continuous devices—the Higgins "jerked-bed" contactor and the "cascade-of-baskets" contactor.

The Higgins unit uses intermittent liquid-flow reversals to jerk a bed of resin up a column. In the intervals between pulses, solutions flow down through the resin as in fixed-bed operation. The cascade system uses resin-carrying baskets which move countercurrent to the uranium-bearing solution.

With neither type of unit must the solution previously be filtered, as with a fixed bed; they both can handle a mineral pulp or slurry as it is produced by the leaching process.

Another ion exchange development may open up new possibilities in waste liquor disposal from sulfite pulping processes. Rayonier has come up with a modified amine anion-exchange resin which adsorbs lignosulfonates from a liquor containing metallic ions.

Metals usually have to be removed before solutions can be treated with resins of this general class. Rayonier, however, has made a resin that is far more receptive to large organic molecules in the face of competition by metals. This is done by converting all primary and secondary amine groups to the tertiary form, and without developing unwanted quaternary groups.

Ion exclusion, introduced by Dow Chemical three years ago, is getting serious study in a Lever Bros. pilot process for removing salt from glycerine. Except for a final polishing step via ion exchange, bulk of the work is done by ion exclusion at a definite cost advantage.

#### **Pulp Processes Provide Flexibility**

New developments reflect changing conditions in raw materials and markets, will help balance supplies of pulpwood and offer new hope in solving the stream pollution problem.

Many of the problems facing the chemical engineer engaged in the production of cellulose pulp arise from the shifting relationships between wood supply, grades of pulp, markets and stream pollution. Pulping technology is proving to be an adaptable pivot point to keep the factors in balance.

How the chemical engineer can adapt pulping processes to fit changing wood supply is shown dramatically by recent developments in the utilization of hardwood to offset dwindling supplies of softwoods. Great Northern Paper Co., for instance, is now producing newsprint from plentiful hardwoods by a technique known as "chemigroundwood" pulping. Whole, unchipped hardwood logs are impregnated and cooked with sodium sulfite solution, then pulped by grinding.

Sulfite pulping has been modified to pulp hardwoods. Production of pulp by the neutral sulfite semichemical process jumped from 500,000 to 1,120,000 tons per year between 1949 and 1954. With adaptations of this process a wide range of pulps can be produced.

Through such modifications in pulping procedures, supply of pulpwood is now in better balance. In fact, such factors may have been behind a recent statement by the chief of the U. S. Forest Service that, for the first time within recent years, the United States is replenishing stands of pulpwood as fast as they are being cut.

Developments abroad reflect some of the same pressures. A new sulfite process recently put into commercial use in Sweden uses a soda-base cooking liquor to produce a high-quality pulp from pine pulpwood. It's coupled with a new recovery circuit that saves chemicals and cuts pollution.

The pollution problem will no doubt influence the direction of further change and possible growth in sulfite pulping. If it comes, change will be based on conversion from lime base to magnesia, ammonia or soda base. Any of these will permit greater recovery of chemicals and lower stream pollution.

First ammonia-base sulfite mill went on stream ten years ago. Today, there are ten such mills in the U. S. and five in Canada. Should ammonia prices decrease with the rising flood of output there may be an accelerating trend toward greater use of this process.

With diversification of pulping techniques, pulp mills look to a more stable position in the face of continually shifting economic, political and natural factors.



# based on today's trends in Production Costs

In view of today's favorable economic conditions, why are chemical engineers so concerned with cost reduction?

Engineers who struggled through the depression of the '30's will remember that most of their work was definitely oriented towards cost reduction. While today's conditions are vastly different, the emphasis is again turning towards cost reduction. Here's why:

• Wage rates and fringe benefits continue to rise at a steady, almost predictable, rate.

 Basic raw materials are increasing in cost with the increased difficulties and distances involved in getting them.

 Keener competition for the consumer's dollar takes greater research and sales effort.

• Product and process obsolescence is more rapid.

Little, if any, tax relief is in sight.
Operation at less than full capacity is now common.

Production engineers are tightening up their control of operating, materials handling and maintenance costs. Design engineers are specifying better materials of construction and more efficient equipment. Research and development engineers are studying new processing techniques which promise lower costs and higher yields. These types of activities are illustrated in the following review of recent technical developments aimed at cost reduction.

#### Fermentation May Be the Answer

Microorganisms can produce specific transformations in complex organic syntheses, overcoming economic hurdles virtually insurmountable by chemical processes.

To chemical engineers on the hunt for new techniques to reduce processing costs, fermentation offers intriguing possibilities.

Not since World War II work on penicillin has fermentation technology shown so much processing potential. Last year saw the production of two more antiarthritic hormones via a microorganism-effected reaction, bringing the score to four such chemicals in four years.

Hormone synthesis differs from citric acid or

antibiotics manufacture in that fermentation is not the whole show. Rather, fermentation supplies the finishing touches—with pinpoint microbiological tranformations—to complex chemical syntheses. Therein lies fermentation's new strength and its hold on the attention of a wider segment of industry, perhaps, than ever before—its ability to perform reactions which pose an obstacle in otherwise feasible chemical processes.

Microorganisms have been used commercially, for instance, to add hydroxyl or ketone groups (in hydrocortisone and cortisone syntheses); to remove hydrogen (yielding the two new hormones, prednisolone and prednisone); to reduce side chains (dehydrocholesterol); and to control molecular size (dextran). It's possible, although not yet commercially justifiable, to hydrogenate, epoxidate, enlarge rings from five to six members and to exchange hydroxyl groups for ketone groups—all by fermentation processes. And microorganisms can determine the location, as well as the type, of the reaction.

Look, then, for increasing use of fermentation as a complement to chemical synthesis and for further integration of microbial and chemical processes to obtain more economical operation.

#### Moving Beds Challenge Fluid Beds

Long neglected in the headlong rush to fluid beds, moving beds are now getting their share of attention, especially for solids-gas processes requiring large numbers of stages.

Another technique which promises to point the way to lower processing costs is the moving bed. Until recently chemical engineers, more enthralled by the fluidized bed, were inclined to overlook the moving bed despite its long history of successful use in such operations as pig iron and cement manufacture.

Now, however, the emphasis seems to be in better balance. Chemical engineers are hard at work investigating the feasibility of adapting the movingbed technique to the economic production of a broad range of chemicals and metals.

The moving-bed technique is a simple way of providing countercurrent or parallel flow of solids and gases through a large number of stages. This can't be done in a fluidized bed without high capital

investment and a complicated arrangement of equipment.

Recent applications of moving beds include pelletizing of taconite, chlorination of ilmenite, Hypersorption with activated carbon and Thermofor catalytic cracking.

Future applications are almost unlimited. For example, in a proposed Bureau of Mines process for recovery of manganese from low-grade ores, the key sulfatization step takes place in a moving-bed shaft furnace. There is renewed interest in the use of moving-bed kilns for the production of portland cement in the U. S. in order to improve on the relatively poor thermal efficiencies of rotary kilns. And reduction of metal oxides, such as CuO, NiO and WO<sub>3</sub> can be handled in moving-bed shaft reactors.

One suggested process for the production of metals involves the nitrates instead of the traditional sulfates. An aqueous slurry of the ore is treated with a gaseous stream of NO and NO<sub>2</sub> to form metal nitrates. Nitrate pellets are then decomposed in a moving-bed unit, from which the effluent gases containing NO and NO<sub>2</sub> are recycled to react with additional feed.

Many chemical reactions that might be carried out in moving-bed processes have been investigated or patented. Some—if not all—should prove to be technically feasible. Among them are the reduction of SO<sub>2</sub> to sulfur, production of phosgene from CO and chlorine, oxidation of ethylene to ethylene oxide and steam reforming of methane for the production of synthesis gas.

#### **Evaporation Scores New Advances**

Recent developments in evaporation and drying methods, such as the atomized suspension technique, capitalize on faster heat transfer to get lower costs and better product quality.

Major consumers of process energy are evaporation and drying operations. Improved techniques offer the chemical engineer significant rewards in reduced costs, better control and improved product quality.

With these incentives in mind, chemical engineers have been eager to try out the Turba-Film evaporator introduced into the U. S. from Switzerland a few years ago. Within the past year there has been ample evidence that this agitated, falling-film unit has gained fairly wide acceptance in the chemical process industries. It is reported to give high heattransfer rates and short in-process times on a continuous basis.

Another film evaporator, horizontal rather than vertical, was introduced last year. The horizontal chamber and rotor are tapered; by moving the rotor axially the thickness of the liquid film can be varied over wide limits, hence the name, Ajust-O-Film

The atomized suspension technique is going to bear watching over the next few years. This is a new approach to evaporation and drying problems. On the brink of commercialization, atomized suspension concentrates solutions or slurries by evaporation, dries the solids and then thermally processes them, if desired. It's all done in one downflow pass through a vertical tower. Radiant heat from the tower walls is transferred to the falling particles very rapidly because there is no air film present.

Still another new technique is similar to atomized suspension in one respect—absence of an air film helps achieve high transfer rates for drying wet filter cakes and granular solids. In a standard Turbo dryer, the usual steam tubes are replaced by gas-fired, radiant-tube heaters. Superheated vapor transfers heat to the material almost entirely by convection. Heat consumption is one-third lower than with a conventional hot-air system; drying rate is so rapid that the falling-rate period is almost nonexistent.

Fluid-bed drying is on the increase, with latest application to fine coal. Units can handle coal particles up to 1½ in., heavier materials up to ¾ in. size. Here again is a method that features rapid heat transfer, achieved through intimate contact between fine particles and moving hot gas. In addition, it can make a size separation, such as removing dust ahead of a kiln.

#### Any Limit on Process Conditions?

Boosting of temperatures and pressures may open up new vistas of chemical processing, but problems in mechanical design and materials of construction must first be solved.

Chemical engineers who find little challenge in the application of these well defined techniques to cost reduction and process development can join the ranks of those who are pioneering in the littleexplored territory of extreme process conditions.

Fairly high temperatures have been commonplace since the ancients first smelted ores to get metals and fused mixtures of oxides to get glass and ceramics. Haber's nitrogen fixation process, then polyethylene, opened up the field of high-pressure technology.

But today's target is to learn how to use high temperatures and pressures simultaneously. This is no simple task.

It isn't just a case of deciding whether or not extreme conditions will make a reaction go. A big problem is the design of massive structures with thick walls exposed to stress gradients varying with time, finding the safest and most economical vessel design to handle extreme conditions.

Today's materials of construction almost invariably fail miserably. Their yield point is too low. High pressures encourage hydrogen embrittlement. When both pressure and temperature are high, chemical attack begins; in certain ranges a 25 C. temperature increase may change corrosion effects from "negligible" to "catastrophic." Stress gradients seriously limit the useful life of vessels. While copper-based alloys resist both embrittlement and chemical attack, their relatively low strength and 500 C. limit make them useless under extreme conditions. Preliminary tests indicate that alloys

with metals whose oxides form protective coatings

(Al, Cr, etc.) may be the key.

Closures for reactors are also a problem. Most of the dependable ones are too cumbersome; improved designs that open and close rapidly must be developed. At a recent meeting a speaker from Autoclave Engineers cited an example of this kind of problem. Since a delta closure takes a whole day to complete, a full Bridgman closure was applied to a test reactor. The assembly successfully withstood the test conditions of 50,000 psi. and 1,000 F. But after the test it couldn't be opened.

Progress is being made, nevertheless. An early design of an experimental reactor required 600 lb. of 2½-in. nuts and bolts just to close it. A newer unit for the same service has a total weight of

only 400 lb.

Still another problem is containment or shielding. Vessel enclosures are usually reinforced concrete; they may have ballistic pendulum fronts with a weak rear wall facing an unoccupied area or a blasting net. Dow engineers report that they rely on an unoccupied area one mile deep by two miles wide behind their units. They previously tried a wall 18 ft. high placed 8 ft. from the rear blowout wall, but got a return shock wave that did more damage than if the wall had been absent.

The uppermost question in many engineers' minds today is, "How far can we go?" Ultimate aim seems to be 50,000-100,000 atm. and 2,000-3,000 C. The engineers will need a lot more information on materials of construction, equipment design, chemical and physical equilibria and rate processes if

they ever achieve these goals.

#### Cost Standards Ignore Past History

Engineering analyses of process capabilities with present equipment will provide attainable cost-reduction goals, will point the way to further savings with better equipment.

A direct, frontal approach to the problem of cost control is the greater use of "rational," not "his-

torical," cost standards.

Chemical engineers are making important contributions in this area. Their studies are resulting in refinements to the commonly used cost standards that rely heavily on historical data developed in the "fat" years.

Out of these efforts have come two significant advances in cost standards—the "production-control" standard and the "cost-reduction" standard.

Production-control standards are based on process capabilities rather than past history. They bring to light potential savings which require no capital expenditure. For example, past history may show that a certain operation has, over the years, consumed an average of 4.7 lb. steam per lb. of product. By thorough study and experimentation, the engineer finds that 4.0 lb. can do the job if the operation is performed properly or if the customary operating procedure is revised.

Cost-reduction standards are based on engineering studies of theoretical or ultimate capabilities, The operation which historically consumed 4.7 lb. of steam and could be operated with 4.0 lb. using existing equipment would likely consume only 2.2 lb. with more efficient, better designed equipment.

So it is that good cost standards—the basis for effective cost reduction—depend to a large extent on contributions that chemical engineers can make. It's not difficult to plan the best course of action once good cost standards have been developed.

#### Better Materials Extend Plant Life

New alloys, improved plastics and protective coatings use cheaper and more abundant materials, provide better corrosion resistance and offer hope in reducing maintenance costs.

Economies of large-scale production and increasing use of automatic process control have combined to minimize the contribution of "direct operating labor" to total production costs in today's chemical processing plant. Most of the labor reduction studies of the future, therefore, will aim at two other targets—materials handling and maintenance.

Significant developments of the past year, both in base materials and in protective coatings, give the chemical engineer new and improved means of increasing the life of his equipment—from cor-

rosion as well as mechanical standpoints.

A new alloy, Nionel (21% Cr, 40% Ni, 3% Mo, 1.75% Cu, 31% Fe), boasts versatility as an outstanding characteristic. It can resist both severe oxidizing and reducing conditions as well as higher-cost alloys do. It is frequently capable of filling the gap between stainless alloys of the Durimet 20 type on one hand and the Hastelloys and Chlorimets on the other.

Another new engineering material—ductile austenitic iron—combines the strength and ductility of ductile cast iron with the resistance to corrosion, heat and metal-to-metal wear of conventional nickel austenitic iron castings. Strength and duc-

tility approach that of cast steel.

Manganese stainless steels are making notable progress. In these alloys the critically short nickel is replaced entirely or in part by manganese. Through the use of nitrogen contents of 0.50%, steels with more than 17% Cr, with little or no Ni, can be made completely austenitic even at rolling temperatures. High strength-weight ratios provide an excellent opportunity for the new Cr-Mn-N steels to compete favorably with the light metal alloys.

In the plastics field, irradiated polyethylene is becoming more firmly established as a distinctly different material. Under bombardment by extremely high-energy electrons, conventional polyethylene is transformed from an easily fused thermoplastic into a thermoset material which is mechanically stable at temperatures as high as 400 F. Solvent resistance is increased, stress cracking is completely eliminated.

Coatings are making progress on many fronts. In the organic field, most notable trend seems to be the emergence of a number of new high-build vinyl coatings. Until recently, vinyl formulations normally yielded dry thicknesses of only ½ to 1 mil, requiring a costly five to six coats to attain the optimum 5-mil thickness for general plant maintenance. Now, by means of hot-spray applications and mastics, the low-build problem has been licked. With their inherent chemical resistance and improved adhesion, vinyls will be getting a big play.

Chemical nickel plating has now reached the stage where process equipment is being plated for non-AEC uses. Costs are roughly the same as for electroplating, but chemical plating gives uniform thickness over intricate surfaces, low porosity,

excellent adhesion and high hardness.

Zinc-filled silicate coatings are also attracting quite a bit of attention. Compared with all-zinc coatings, they have the important advantages of better corrosion resistance and cold application to existing structures. They are being used alone, and as a primer for vinyl top coatings. Chemical industry applications include cooling towers, tank exteriors, outside piping and stacks.

#### **Synthetics Yield Improved Motors**

Polyesters, silicones and other new insulating materials reduce motor sizes, lengthen useful lives; further improvements promise ultimate cost reductions of 20% or more.

The ubiquitous electric motor is often just taken for granted. Yet there have been recent improvements in motor design and construction which will contribute to lower investment and reduced mainte-

nance costs in the years ahead.

The chemical engineer, who stands to reap the benefits offered by improved motors, has contributed in large measure to these improvements. For within the shells of today's motors (and generators), barriers of modern synthetic materials insulate wire conductors and coils. To a greater degree than heretofore possible, the vital electrical elements are protected under extreme environmental and operating conditions.

One new coil insulation for 100-3,000-hp. Class A motors (seven-year minimum life at 105 C.) is a combination of polyester film and tape with a synthetic hydrocarbon resin. Gains of 50% in life, 50% dielectric strength and 600% mechanical strength are reported. More horsepower can be

packed into a given frame size.

Silicone rubber as a complete insulation system for form-wound coils was introduced this year for Class H service (seven-year minimum life at 180 C.). Material is applied to the entire coil structure, then vulcanized to form a homogeneous, void-free dielectric barrier. Outstanding resistance to heat, moisture, chemicals and abrasion make possible the use of semiprotected or open frames where totally enclosed construction was formerly required.

Still another form-wound Class H system uses silicone resin-bonded mica tape impregnated under vacuum and pressure with a thermosetting silicone

resin.

Other products of the chemical industry under

field test evaluation in electrical equipment are epoxy, isocyanate, triallyl cyanurate and irradiated polyethylene resins.

An indication of what's ahead is General Electric's recent announcement of a ten-year study project on insulating materials for electrical apparatus. Ultimate cost reductions of 20% or greater are predicted by developing insulations whose properties will radically improve the apparatus.

#### **Portability Cuts Handling Costs**

Latest developments in portable containers will help reduce labor and shipping costs, avoid product contamination in intra- and interplant handling of bulk materials.

Among the important recent advances in materials handling, those of most significance to the chemical engineer are cheap expendable pallets, large collapsible rubber containers and portable aluminum bins.

A new expendable pallet developed by American Cyanamid costs about 50¢, compared with \$1.50 for other expendables. It consists of a high-wet-strength kraft paper sheet, with paper tubes inserted in preformed side sleeves for lifting forks.

In addition to its low cost, the new pallet has another important advantage over other expendables—it permits successful double-stacking in rail shipment. Where the customer has only a 2,000-lb-capacity fork lift, double-stacking is often necessary in order to load the car sufficiently to qualify for minimum freight rate.

Collapsible neoprene-and-fabric containers of about 300 cu. ft. capacity represent another important new development in the interplant handling of bulk materials. Pioneered by U. S. Rubber Co., they are already being used by Bakelite Co. for shipping polyethylene resin to its customers. Bakelite reports savings of ½¢ per lb. over shipments in bags.

The containers are so designed that contamination by dust, dirt, fly ash, cut bag fibers, etc., is avoided. They fit into railroad gondola cars and open-top truck trailers. Empty containers are collapsed and stored outdoors, requiring no ware-

house space.

For bulk materials handling, both intra- and interplant, the portable aluminum bins developed by Tote Systems are gaining favor in the chemical process industries. The completely enclosed bins avoid the dust, contamination and spillage that often accompany the filling and emptying of drums and barrels. They are built with short legs to facilitate fork-trucking; appropriate tilting devices are used for emptying. The manual handling usually involved in filling, transporting and emptying of drums and barrels is eliminated.

That chemical engineers are recognizing the importance of the materials handling function is indicated by the large number of chemical industry representatives at a recent materials handling conference at Lake Placid. The attractive cost-reduction opportunities in this field are worth active

pursuit.



# based on today's trends in Living Standards

As far as the layman is concerned, the development of new and better consumer products is the best measure of technological advance.

The chemical developments that make the headlines in the daily newspapers—and the Sunday supplements—are the new "wonder" products—wonder drugs, wonder metals, wonder fibers, wonder weapons. And now the "wonder" aspect is beginning to wear thin.

For today's living standards are so far above those of our grandparents that consumers expect—even demand—new chemical products to ease their chores and enrich their leisure hours. Gone are the days when the consumer shied away from "artificial" chemical products. Today a label bearing the word "synthetic" is almost a sure way to get the consumer's attention.

Underlying the situation today are well defined trends, both economic and psychological. On the economic side, the consumer's purchasing power is climbing and his available leisure time is growing. Thanks to the engineer's success in controlling production costs, rising wage rates continue to lead rising prices. The average work week is getting shorter, vacations are getting longer, workers are retiring at earlier ages and living longer. Even the farmer, while perhaps not sharing today in the climbing purchasing power of the factory worker, is certainly enjoying more leisure.

On the psychological side, the consumer is growing more discriminating, and at the same time more taste-conscious, in his demands. With a number of synthetic fibers to choose from, for example, he (or she) looks for the one which offers the most desirable combination of properties for the particular application, whether a suit, dress or carpet.

These trends show up in the work of the chemical engineer today and will continue to influence the direction of his activities in the days ahead.

#### Which Way to High Octanes?

Demands for motor fuels of higher antiknock rating will challenge the petroleum refiners' ingenuity in developing economical, highyield processes for 100-octane gasoline.

One of the best evidences of rising living standards in the U. S. is the steadily increasing horse-

power ratings of automobile engines, with their requirements for fuel of higher antiknock ratings.

Knottiest problem facing oil refiners today is how to boost octanes the cheapest way, i.e., with the least yield loss. Catalytic reforming has been highly touted and is now standard industry practice. But it's rapidly nearing its practical octane limit (optimum severity), and there's still no letup in the push toward still higher octanes. (Premium gasoline has reached 97.4 octane number in some areas.)

A lot of chemical engineering effort is being made to lick this situation. Last year saw the introduction of two proposed economic routes to 100-octane fuel—Universal Oil Products' Rexforming process and Houdry Process Corp.'s Iso-Plus reforming. Both use mild catalytic reforming followed by further reforming treatment of the low-octane paraffinic molecules which resist the first pass. The mild conditions give higher yield, but lower total octane, than severe reforming. The second pass, however, kicks the over-all octane rating up to the desired level.

Rexforming involves three steps: Mild Platforming; solvent extraction to separate the low-octane nonaromatics from the high-octane components; recycling of the low-octane fraction to the reformer. The separation step isn't critical, since small amounts of aromatics left in the recycled fraction don't seriously hurt process efficiency.

Iso-Plus is essentially a mild Houdriforming followed by three variations of further reforming. In the first, Houdriformate is separated by suitable means into aromatic and paraffin fractions, with the paraffins treated further in a separate Houdriformer. In the second variation the paraffins are recycled to the original Houdriformer. (This is the same scheme as Rexforming.) In the third variation the entire Houdriformer product skips the separation step, goes directly to a thermal reformer. This upgrades the paraffins with minimum loss of aromatics. The first scheme yields the most 100-octane gasoline but has the highest capital cost. The third scheme is attractive because of its low investment and operating costs.

Actually, Rexforming and Iso-Plus represent new philosophy rather than new technology, since they are simply novel combinations of established processes. But they do spotlight the refiners' most probable route to higher octanes—selective processing of narrow petroleum fractions.

In the near future paraffins will get even more

specialized attention. This is particularly true for normal pentane, which is probably the worst actor in the octane picture. What's needed is a way to separate pentane from reformates, so that it can then be isomerized in a separate unit or re-reformed to higher octane. Development of suitable processes will be occupying the chemical engineer's attention in the months ahead.

#### **Pollution Problems Demand Attention**

Although most pollution problems can be solved with present knowhow, economics still dictates industry's course; emphasis will be on development of cheaper disposal methods.

Several factors associated with today's rising living standards account for the increasing pressure on the chemical industry to minimize its contribution to pollution of the atmosphere and the waterways.

For one thing, the residents of industrial communities, with their nicer homes and more expensive cars, object more strenuously to fumes and dirt than did an earlier generation, which actually welcomed black smokestacks as signs of good times. Another factor is the increasing availability of leisure time for those whose recreational pursuits require unpolluted waters.

Finally, the public has come to accept the twin philosophies that modern technology can easily solve any pollution problem and that industry can easily afford the necessary facilities. Though the deas are far from reality, they provide the basis for a lot of the chemical engineer's activities these days.

Brightest spotlight today is on air-pollution problems. An anxious industry, uncomfortable in its glare, is looking for ways of cutting the problem down to manageable size.

One way is to go to higher stacks and higher velocities for ejecting waste gases from these stacks, so as to capitalize on the natural purifying and liluting capacity of the atmosphere. By some of today's standards a 200-ft. stack is a "shortie." British power plants are relying more on 300-ft.-high stacks to minimize pollution from SO<sub>2</sub> than on trying to remove the SO<sub>2</sub> from the effluent gases. In the U. S., the smelter operators have pioneered the tall stack principle, boasting at least four stacks close to the 600-ft. mark. What is probably the world's tallest stack, towering some 611 ft. above grade, discharges an effluent containing 0.5-1.0% SO<sub>2</sub>.

Engineers are finding these principles to be of

• Combine as many effiuents as practical so that there are fewer, but wider stacks. The wider the stack, the less will the effluent's path be adversely affected by eddies until it's several hundred feet high.

• Emit gases hot; their increased buoyancy will carry them higher and improve the degree of dispersion. As a corollary, think twice before washing gases prior to ejection, particularly if removal of pollutants is still incomplete. This practice may boomerang, for the cool, heavier gases are less easily dispersed and may prove more of a nuisance than hot, unwashed (and rapidly dispersing) gases.

What industry does about stream pollution in the future will probably be limited more by economic conditions than by technological knowhow. Design of plants for the biological oxidation of organic wastes is maturing rapidly. What used to be pretty much a trial-and-error approach based on empirical engineering methods has now evolved into a much more precise application of known biochemical concepts. Says one authority: "It is now possible to design a bio-oxidation plant with as much confidence as is normally placed in the design of any conventional process unit."

An economic breakthrough in the water-pollution field is promised by the Zimmermann "wet combustion" process for disposing of liquid organic wastes. Under study for several years, this process is now being scheduled for commercial-scale use by Norway's biggest pulp and paper maker. In this process, organic wastes in aqueous solution are oxidized non-catalytically with air at elevated pressures and temperatures. Economic attraction is the recovery of useful energy from the high-pressure steam generated by the oxidation process. The Norwegian installation expects to reap 220,000 lb. per hr. of process steam, which will provide rapid payout of the plant on the basis of the savings in expensive, imported fuel oil.

U. S. chemical engineers will certainly be studying the possible application of the Zimmermann process as a means of converting a debit operation into a credit.

#### Polyethylene Shifts Into Low

Economic advantage of low-pressure operation may be insignificant compared with the fact that the new polyethylenes' unique properties can open up big new markets.

In the plastics field polyethylene was the technology headliner last year, as low-pressure polymerization caught industry's fancy by promising a higher-melting, higher-density, more rigid product than can be made by conventional high-pressure methods. Even as a host of new high-pressure plants were starting up, U. S. chemical firms were rushing to take out licenses on one or both of the two low-pressure techniques now available—one developed by Phillips Chemical, the other by Karl Ziegler of Max Planck Institute, Berlin.

Vital to both processes are specific, tailor-made catalysts whose exact natures and compositions haven't been fully disclosed. Phillips is believed to use a highly hexavalent chrome oxide on a silicalumina support. In operation, ethylene is polymerized in the liquid phase with a paraffin hydrocarbon diluent (such as isopentane) at about 500 psi. and 300 F.

Ziegler gets by with even lower pressures and temperatures by using a metal alkyl catalyst, probably containing aluminum ethylate. Though this introduces the possibility of metal contamination of the product, Ziegler says water washing effectively removes all catalyst. Commercial plants based on Ziegler's research will no doubt differ considerably. With the exception of Hercules Powder, U. S. licensees of this process have purchased mostly laboratory and patent information, little real commercial knowhow.

A third low-pressure polyethylene is being developed by Standard Oil of Indiana. Though it's still in the laboratory stage, at least eight patents have been issued covering various possible routes. Mentioned most often is a pressure of about 1,000 psi. and temperatures of 400-500 F. Probable catalyst is a subhexavalent molybdenum oxide.

When these various new processes reach commercial stature—and several full-scale plants are definitely planned—what will they offer? There are those who discount any real economic advantage of the more moderate conditions; higher pressures require only a modest increment of power, and the reaction equipment is actually much smaller. The big hurdle—development of high-pressure knowhow—was overcome years ago.

Far more important is the fact that the new processes turn out new products with unique properties that will broaden the whole plastics market. For many present polyethylene uses, particularly those requiring high flexibility, the new type actually won't be as good as the old. But in markets like toys, piping and milk bottles, that often require greater rigidity and better heat-resistance than is inherent in high-pressure polyethylene, the new products should make real strides.

#### **Polyurethanes Face Great Future**

These new synthetics, recently arrived on the American scene, promise many new product developments in foams, adhesives, coatings and tire treads that will outlast the car.

Competing with polyethylene last year for the headlines—and getting at least its share of space in the nontechnical press—was the polyurethane family.

These polymers, while known for many years, blossomed into prominence only recently. Even many chemical engineers today are apparently unaware of the bustle of activity in this field.

Made by reacting isocyanates with polyester resins, the polyurethanes can take any of several forms. Right now, foams—both rigid and flexible—dominate the scene. But up-and-coming polyurethane products also include adhesives, wire coatings, paints, fibers and automobile tires. Urethane rubber tire treads which promise to outwear the life of the car are being field-tested.

Polyurethane research has been conducted in both Germany and the U. S. Urethane rubbers have been produced in Europe under the Bayer trade name, Vulcollan. Among the U. S. firms showing early interest in polyurethanes was Lockheed Aircraft, who developed methods of stiffening cavities in aircraft structures by filling them with polyurethane foam.

Typical starting materials for producing a polyurethane are tolylene diisocyanate (derived from toluene by nitration, reduction and phosgenation) and ethylene glycol adipate (made from ethylene glycol and adipic acid). Addition of water or carboxylic acids results in the generation of  $CO_2$ , leading to the formation of foams. Requirements for the chemical intermediates are sparking big construction programs throughout the industry.

Polyurethane foams are claimed to be lighter and stronger than foam rubber, resistant to oil, dirt and dry-cleaning solvents. They can be made in a variety of densities, won't rot, age or tear; have excellent insulating and electrical properties; can be dyed, sewed, glued, cut into any desired shape. They're finding application in mattresses, seat cushions, clothing liners, toys and scores of other products.

When the polyurethane adhesives, paints, rubber and fibers also reach commercialization, many more chemical engineers are going to find themselves engaged in an exciting new field of activity.

#### New Synthetics Need Dibasic Acids

Recent developments in this vital family of chemical intermediates include new products, new raw materials, new processes and new production techniques.

Recent developments in polyester and polyamide fibers, polyester and polyurethane resins, plasticizers, polyester coatings and synthetic lubricants have focused the chemical engineer's attention on a family of chemical intermediates common to all these products—the dibasic acids.

It's no wonder, then, that technological advances in dibasics figure heavily in the past year's chemical achievements. Six recent process developments in particular (many more are on the way) seem destined to make big marks.

Perhaps the one being watched with most interest is Oronite's process for isophthalic acid, now being used in a new 50-million lb. per year plant. Oronite's hope is that isophthalic will challenge phthalic anhydride in many of the latter's traditional markets. It gives higher heat resistance, and its lower volatility avoids the need for closed resin kettles. Isophthalic acid is made by oxidizing 95% (or better) meta-xylene. Ethyl benzene and ortho-xylene present in the feed drop out as benzoic acid during processing, giving a product consisting of 98% isophthalic and 2% terephthalic acid.

Xylene is also the source of dimethyl terephthalate made in Hercules Powder's new plant; in this case it's high-purity para-xylene. Hercules first oxidizes one methyl group to give para-toluic acid, which is converted to its methyl ester. The operation is repeated on the second methyl group to give DMT, whose big market is in the production of polyethylene terephthalate films and fibers.

The third xylene isomer, ortho-xylene, is already well established as a starting material for phthalic anhydride. A new twist, however, is production of phthalic from mixed xylenes. Richfield Oil has de-

cided to commercialize a process developed by Stanford Research Institute which uses two-stage air oxidation with a cobalt soap catalyst. In the first stage, ethyl benzene impurity in the xylenes is recovered as acetophenone, leaving toluic acids. These are more severely oxidized in the second stage.

Stanford also contributes a new development in the aliphatic dibasic acids. In a process not yet commercialized, tallow fatty acids and saturated fatty acids are oxidized with dilute nitric acid to give a mixture of mono- and dibasic fatty acids. Residence time is said to be less than for conventional nitric acid oxidation, and 80% of the total acid yield is dibasic, mostly C<sub>0</sub> to C<sub>10</sub>. A major disadvantage, of course, is that the product is a mixture of acids.

Also a mixture is U. S. Industrial Chemical's recently announced Isosebacic acid, still in the pilotplant stage. It consists of various sebacic acid isomers made from butadiene and metallic sodium.

Oxidation of hydrocarbons isn't the only good way to make dibasic acids, as pointed up strongly last summer when Chas. Pfizer revealed volume production of itaconic acid by fermentation of molasses. And, says Pfizer, itaconic is just the first of many new fermentation-produced acids and esters, some of which are already on the market.

Such developments as these don't have the glamour of the new fibers and plastics, but they will help make those products available at prices the consumer can afford.

#### **New Fibers Don Working Clothes**

Laying aside their "miracle fiber" halos, the synthetics are carving out their respective niches in specific markets; new products are aimed at pinpointed applications.

With new synthetics making their debuts at frequent intervals, chemical engineers working with fibers have put in a busy year. In 1956 they'll probably be even busier.

Arnel, Darlan, Creslan, vinylon and nylon-6 were in the spotlight in 1955. Here's how they fit into the picture:

• Arnel is a cellulose triacetate fiber developed in Great Britain and Canada. It features ease of care and is adaptable to a wide range of colors, designs and prints. Cost of the staple is about 50% greater than other acetate staples.

• Darlan, a vinylidene cyanide polymer, expects to find its biggest outlet in women's luxury pile and "fur" coats. Ultra-soft and static-free, it will command a premium price.

 Creslan, based on acrylonitrile, features ease and uniformity of dyeing—either alone or combined with wool

 Vinylon, a polyvinyl alcohol fiber, is at present made only in Japan. Its potential low cost and ability to absorb water make it a rival of cotton for some uses.

 Nylon-6, a caprolactam polymer, headed for the big time as three U. S. producers got under way. One significant trend noted during the past year is that both new and older man-made fibers are shucking their "miracle" tags and getting down to work. Specialization in use is snowballing; the newer entries are being tailored for specific uses and aimed toward carefully defined markets even while still in the research stage.

Older fibers, too, are being altered to fit them for specific applications and, in the process, some long-term problems are being solved. Chemical treatments for cotton, such as cyanoethylation, are imparting improved properties to this standby and fitting it for new industrial and domestic uses. Dope-dyeing of synthetics—acetate, viscose, dynel and saran—seems to be the answer to many problems.

Chemical engineers may be able to capitalize on some of their own recent developments. Felts made of synthetic fibers can be used as filter media; they are easy to make, easy to clean, resist chemical and microbial attack. New materials for specialized uses are papers made of synthetic fibers. Featuring high strength, light weight, chemical and mold resistance, these papers may be used as packaging materials and for filtering.

#### Choose Your Route to Fatty Alcohols

New catalytic hydrogenation processes find competition from sodium reduction process is still keen; specific type of products wanted is a deciding factor.

A versatile family of chemical intermediates chalking up notable progress last year was the fatty alcohols. These materials, many of them just making their commercial debut, go into synthetic detergents, protective coatings, plasticizers and many other end uses.

Developments have been in both processes and products. On the process side, three new catalytic hydrogenation routes were introduced during the past twelve months. Two of these have been demonstrated in Europe—the SBA process in Belgium and the Sinnova process in France. The third new process is home-grown, by Givaudan-Delawanna. A fourth, older process also came from Europe—the De Nora process from Italy, used in this country since 1950 by Procter & Gamble.

Catalytic hydrogenation must compete with another method for converting fatty acids to fatty alcohols—sodium reduction. Each method has its particular advantages and disadvantages. Hydrogenation tends to saturate the double bonds of unsaturated fatty acids.

This is one reason why Archer-Daniels-Midland chose sodium reduction for its new plant at Ashtabula, Ohio. Among the wide variety of fatty alcohol products now coming out of this plant are some with as many as five carbon-to-carbon double bonds. However, ADM is not pinning all its hopes on sodium reduction. The company is working on catalytic hydrogenation as a cheaper route to saturated alcohols, is hopeful even of improving on the four available processes.



# based on today's trends in Manpower

In 1928 there was only one engineer in the U. S. to every 100 workers. By 1953 the ratio had risen to one engineer for every 40 workers. Every indication today points to a continuing increase in this ratio.

All the trends discussed earlier in this report—declining availability of cheap raw materials, steadily rising production costs, keener competition for the consumer's dollar—provide the fundamental basis for this increase.

Some have seriously questioned the reality of today's shortage of engineers. But few question the fact that growing numbers of engineers will be needed in all fields of technical endeavor—research, development, design, production, maintenance, sales, management and control.

Much of today's agitation about the question of manpower has been stimulated by statistics which compare the number of engineering graduates being turned out in Russia with the number graduating in the U. S. Agitators gloomily predict that we may soon lose our technical superiority over the Communist countries. Entirely aside from possible military demands, however, are the demands of a growing, healthy, peacetime economy on all the technical skills we can muster.

A lot of the future of the chemical engineer will depend on whether these demands are met, and how. There is some evidence that future technological advances could be limited by a real shortage of engineers and scientists. That's why we should study current technical trends affecting the supply, demand and productivity of trained manpower.

#### **Automation Poses New Problems**

Recent developments point up the need for better understanding—by management, of the attitude of labor, and by engineers, of the characteristics of the process being controlled.

One aspect of technology which last year riveted attention on the manpower question was automation. Increasing use of automatic control instruments is contributing in large measure to the rising ratio of engineers to production workers in today's factory.

Although industry moved a little closer to the

pushbutton age in 1955, the move was more psychological than actual. On a number of occasions engineers and economists, management and labor met to consider the implications of more nearly automatic production processes. As economists began to worry about the effects of automation on labor needs, labor leaders began to wave their arms—some opposing, others applauding—but all demanding that labor needs be stabilized, that the workweek be shortened and that labor's share in automation's profits be increased. Even the government got into the act via a Senate investigating committee.

Actually, the fear of automation that has grown up in some quarters seems anything but justified. If we extrapolate to 1975 the present population trend, the present rate of improvement in living standards as measured by gross national product and the present rate of increase in labor productivity, we find that the labor force will be inadequate, even with the present length of work-week. In order to achieve the predicted living standards of 1975, technology will have to advance at an accelerated pace. And if some decrease in work-week is forced—as it probably will be—then a still larger measure of improved technology will be called for.

In certain industries, some labor relocation will inevitably be required when further automation reduces the present large labor component in the cost of manufacture. However, most economists now believe that this can be taken care of almost unnoticeably by the natural shifts to service industries that higher living standards will demand.

In the chemical process industries, where already labor is usually a minor part of production cost, further automation may demand an increased component of more highly skilled labor. Few process industries, however, stand to benefit through reduced labor needs. Rather, their benefits will come from better products of higher uniformity, from greater safety, lower losses and less reworking, and from higher productivity per dollar of capital investment.

One of the most difficult problems of the past year was to decide what "automation" means. The exact meaning of this "magic" word varies with the one using it. On one hand are those to whom automation means merely more of the same technological evolution that has characterized industry for the last 200 years; to others the word implies

the development of fully automatic plants in which men need only read in instructions to memory devices, then push buttons to start and stop the operations. To the chemical engineer, automation usually means a continuation of the trends toward increasing automaticity which have been developing since about the turn of the century. In the chemical process industries, at least, the trend will be evolutionary rather than revolutionary.

As the evolution continues, all-electronic systems of control are beginning to make themselves felt. New measuring devices of greater sensitivity and greater selectivity are being developed. Perhaps the greatest future need, as well as the most hopeful development taking place today, is in instruments for rapid, automatic end-point analysis and control.

A good many people are beginning to think of the place of the automatic computer in process control. Even today, simple computer elements are used in certain instruments, e.g., ratio controllers. And experimental work is already going forward to adapt more complex computers to the task of correlating the settings of the controllers for all primary variables in a process.

Here is one area calling for the highest technical skill of the chemical engineer. For he needs to understand the process, not in the intuitive fashion of the good operator-who now does the computer's job-but in the mathematical terms necessary to encode the process characteristics for the com-

Seldom are process facts so fully known. This is one reason why computer control will be slow in coming. Another reason is that computer control will be costly to provide and often hard to sell on the basis of payout time. It will probably come first in continuous-flow processes, such as petroleum refining, where there are many plants with similar operations. This makes it possible to find your facts. do your experimenting and make your mistakes on a single unit, then when successful extend the proven ideas to other plants of similar characteristics.

Costly computer control will probably never come to a good many process industries. For these, automation may mean essentially the simplification of manual control methods via miniature instruments, graphic panels, automatic scanning and digital recording. In such plants operators will continue to supervise the automatic control instruments. correlating their control settings as needs arise. In this, they already have the help of compact control panels, immediate automatic analytical results and faster instrument responses. Further help in the future may come from automatic, built-in startup and shutdown procedures.

Management, too, will benefit from increased automation of information handling. The tools are already at hand-automatic data-reduction systems. telemetering devices, automatic handling of computations and other paper work. Some companies are already adapting such equipment to the mechanizing of paper work. These tools are beginning to be considered also for the mechanization of management decisions in some areas. From here in the problem is not one of developing the tools as much as it is the problem of learning how to use

#### **Engineers Hike Their Productivity**

New and improved engineering toolsmathematical, mechanical and proceduralwill come into wider use as engineers seek to make their own efforts more productive.

If increased mechanization and automation can boost the factory worker's productivity, would not the engineer's productivity be enhanced if he is equipped with the most modern tools?

This thought underlies many of today's trends in the practice of engineering. Development of new and improved engineering tools is helping to stretch today's supply of engineers.

Use of physical scale models has become commonplace in engineering work. Now beginning to catch on in a big way is the use of mathematical models, as exemplified by the growth of interest in operations research. There is now an Operations Research Society of America, which publishes its own journal. Some 500 members attended a Los Angeles meeting last August.

One main point emerged from this meeting: Operations research is jelling, from a loose collection of tools and techniques, into an exact science. It has been defined as the application of scientific methods in the selection of alternative solutions to engineering and management problems. It takes the allimportant uncontrolled chance factors into account, using such disciplines as the theory of games, decision functions. Monte Carlo methods (random sampling) and linear programming.

Linear programming has been getting a big play recently. It is a method for coming up with the best practical combination of related and dependent factors in a system, taking operating limitations into account. Basically it involves the algebra of matrices, combined with trial and error, where error is systematically reduced.

In practice, of course, problems can get quite complex. In many situations a lot of data have to be reduced to basic components, then a mathematical representation (model) must be constructed to fit the data. To do this the operations research man must have not only a good background in mathematics and statistics; he must have also an intimate knowledge of the problem and the system involved.

Esso, Merck, Monsanto and Koppers are some of the companies applying linear programming to such problems as: What is the most profitable product mix? What is the best plant location? What is the

lowest-cost production schedule?

Linear programming has some limitations. For instance, all factors must be expressed as linear relationships. Low and high limits on most variables must be known. But for problems within these limitations, linear programming promises to provide an extremely useful engineering tool.

Progress is being made in other areas. For example, utilization of high-speed computers to solve complex problems is beginning to lose some of its aura of mystery as more chemical engineers gain experience in this field. According to one authority, a competent chemical engineer can learn in a few hours time enough of the elementary principles of computer operation to be able to program a complex problem for computer solution. He can facilitate this job by preparing an "information flowsheet," showing the sequence of mathematical steps, including "recycle" of trial results, similar to a process flowsheet. In addition, expert consulting services are available from the computer manufacturers.

Such tools as linear programming and high-speed computers are useful when the solution to a problem can be defined mathematically. There are many problems whose answers depend, not on mathematical equations, but on new ideas. As expressed recently by President DuBridge of California Institute of Technology, "The key figure of the future is the man with his feet on his desk—thinking."

Until recently, few organizations have given much thought to providing the proper atmosphere for encouraging creativity. Within the past few months there have been reports from several companies on different approaches to this problem. In some companies highly creative individuals are made project leaders of teams whose members' abilities and personalities are complementary. In group discussions, ideas are allowed to run wild; the more far-fetched, the better. This technique, known as "brainstorming," has intriguing possibilities for solving the most difficult problems.

There are those who suggest that the simple solution to any shortage of technical manpower is to pay bigger salaries. They decry the narrowing spread between the earnings of technical and non-technical employees. As a matter of basic economics, however, management has been able to boost hourly wages only as hourly productivity has increased. By the same token, engineers will be worth more money when their productivity shows comparable increases through the use of modern engineering tools and techniques.

#### **Needs for Engineers Will Soar**

Increasing dependence of society on contributions of the engineer points to a growing problem in the supply of trained manpower; engineering educators move to meet this need.

This past year saw an increasing proliferation of verbiage on the subject of manpower. Many of the viewpoints were conflicting. There were some who believed that the manpower problem was imaginary, or at the worst, real but temporary. Among those who recognized a longer-range problem, the proposed solutions varied widely.

The facts seem to substantiate the arguments of those who foresee a real, growing problem in the supply of adequately trained technical manpower. The technological trends discussed throughout this entire annual review all have one common denominator—the increasing dependence of modern civilization on the contributions of the engineering profession. Again quoting Dr. DuBridge:

"This great civilization has one terribly important property that we often fail to recognize—it cannot be run by dopes! We have built a civilization that has raised the common man to levels of comfort, and even luxury, that could not have been dreamed of a century ago. But this civilization requires a large supply of uncommon men to keep things going."

The problem today is twofold: First, to get more young people to enroll in engineering courses; second, to do a better educational job in the engineering schools. In neither case is the answer simple or clearent.

Twenty percent of today's college graduates already take their degrees in science or engineering. With suitable incentives this proportion could probably be raised, but by only a modest amount. The alternative is to get more qualified young people to enter college. The joker here is to discover which ones have talent for engineering studies. What with a number of high schools offering inadequate courses, or none at all, in chemistry, physics, geometry and trigonometry, thousands of potential engineers never have a chance to test their talents.

On the engineering education side of the picture, changes are already underway which should make tomorrow's Ch. E. graduate better prepared to take his place in the technological whirlpool of the future.

Speeded by the widespread acceptance of the recommendations made last year by the American Society for Engineering Education, the center of gravity of chemical engineering curricula is rapidly shifting from engineering practice to engineering science. A trend long in the making, it's now gathering momentum from the accelerating pace of technological developments and a swing from empirical methods to those based on theory.

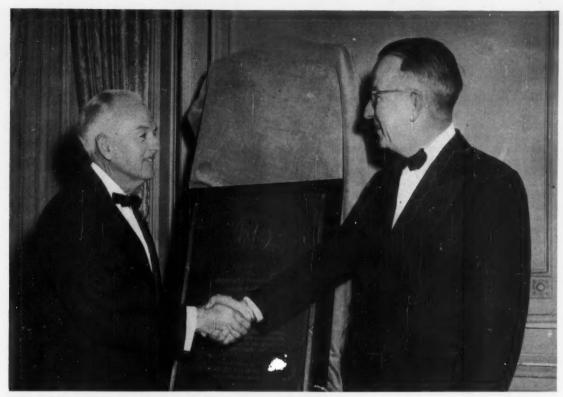
Nowadays, it's just too much for a professor to attempt to teach his charges the ins and outs of up-to-the-minute engineering practice. No matter how timely a certain lecture may be, it's usually on its way out of date by graduation day.

Theoretical generalizations are being taught in place of empirical methods wherever possible. And just as shop, surveying, process descriptions and similar "practical" courses were dropped from many chemical engineering curricula a generation ago to make room for unit operations, so the unit operations are yielding today to the "fundamentals"—mass, heat and momentum transfer, chemical thermodynamics, reaction kinetics, phase equilibria,

Basic sciences, notably mathematics and physics (including solid-state physics), are also getting greater attention and playing a bigger role in the curriculum. And, increasingly, schools emphasize the cultural and broadening subjects to round out the engineer's education.

The result? As this trend continues, the schools will be graduating men with a broad, fundamental grounding in the science of engineering. They'll bring a more theoretical, less empirical approach to their engineering problems.

And the job of instructing them in the up-to-date art and techniques of the job will fall to industry. Programs for such training are already accepted and used, especially among larger companies. The outlook is for this practice to become more widespread and the programs themselves to grow in formality and intensity.



Dr. William R. Collings, president of Dow Corning Corp., and Prof. Walter G. Whitman, chairman of the Award Committee.

# **Intellectual Curiosity**

Catalyst that helped Dow Corning win the 1955 Chemical Engineering Award was intellectual curiosity. So says chemical engineer-president William R. Collings, at impressive presentation ceremonies during Chem Show Week in Philadelphia.

Again the chemical engineering profession has recognized and honored group effort and leadership in developing a new chemical industry—silicones. By vote of an 84-man committee of senior chemical engineering educators, the 1955 Award for Chemical Engineering Achievement has been presented to the Dow Corning Corporation of Midland, Michigan. The occasion was an impressive banquet in the

ballroom of the Bellevue-Stratford Hotel on December 7 before almost 1,000 representatives of the chemical industry and profession. The keynote speaker was General John Edwin Hull, president of the Manufacturing Chemists' Association, whose address on the role of leadership in industrial development is reported on pages 193-4 of this issue.

Again, Sidney D. Kirkpatrick, editorial director of Chemical Engineering and Chemical Week, and secretary of the award committee, served as toastmaster. In his introductory remarks, he pointed out that the Chemical Engineering Achievement Award was established by this magazine in 1933 primarily to encourage the broader

participation of chemical engineers in all the affairs of the process industries. It is unique, therefore, in that it recognizes group effort rather than individual achievement. The roll of its previous recipients is a most distinguished roster of outstanding companies in the chemical engineering field.

The bronze plaque symbolizing the Award was presented to Dow Corning's President, Dr. William R. Collings, by Professor Walter G. Whitman of Massachusetts Institute of Technology, Chairman of the Award Committee, and newly elected President of the American Institute of Chemical Engineers. His brief remarks are noted below and those of the recipient are reported on the next page.

"Tonight we honor a company which has demonstrated remarkable initiative and resourcefulness in creating a group of new and highly useful products. I believe that my associates on the Award Committee have been especially impressed by the broad and pervasive influence of chemical engineers and chemists in its success—not only in the areas of research, process development, design and manufacturing operation but notably in product development, technical sales and managerial responsibility."

—WALTER G. WHITMAN

#### CATALYTIC CURIOSITY

### Wins Chemical Engineering Award

By W. R. Collings

As our people accept this honor, we want you to know that it has come to us only because many others made substantial contributions to our success. We are sure that their curiosity—perhaps I should say their intellectual curiosity—coupled with a desire to make new things and to improve existing products were the dominating forces that resulted in bringing us this Chemical Engineering Achievement Award.

#### Pioneers

First, there was the curiosity of Drs. E. C. Sullivan and W. C. Taylor at Corning about 25 years ago. They wanted to satisfy their curiosity about the relationship of glass to organic materials. So, they engaged Dr. James Franklin Hyde, and later Dr. Rob Roy McGregor to join them in their thinking.

These two men chose diverse but closely related fields of investigation. They were stimulated by certain problems, but their curiosity led each of them into silicon chemistry although along slightly different paths. When the facts they had uncovered regarding silicon-oxygen polymers were disclosed to Dr. Edgar C. Britton of Dow along about 1940, his experienced eye saw in these silicone polymers a broad future pattern of usefulness which is just now becoming more or less visible to the rest of us.

When we call our products silicones, we use a word coined by a predecessor of these men, Professor Frederick Kipping of the University of Nottingham in England. Kipping's curiosity regarding the relation between carbon and silcon chemistry lasted over 35 years. Certainly the persistence of Kipping and his co-workers provided Hyde and McGregor with a substantial background of facts about organosilicon chemistry. So, we must give Dr. Kipping his fair share of credit for the part he played in bringing us this recognition.

Next we must attribute a lot of our success to the early interest that silicones aroused in Harold Boeschenstein, president of Owens-

Corning Fibreglas Corp. and Admiral H. G. Rickover of the U. S. Navy. Certainly the wartime interest of these two men were stimulating influences-one in seeking a companion material for glass fiber the other in getting what he wanted to make better electrical equipment for shipboard use. Their activities were dominant in the establishment of our company and in equipping it to develop and manufacture products during the early years of World War II. Besides these men, the then presidents of our two parent companies-Willard Dow and Glen Cole, together with their associates-were equally foresighted in sponsoring the formation of our company.

#### **Hundreds of Engineers**

But I must call your attention to another group that was even more important and necessary to the achievements for which we are accepting this honor. This group includes hundreds of engineers and other technical people who are employed by our customers and whose curiosity, and whose desire to improve products of many kinds, were so essential to our current success. It seems to me that their counsel, their advice, their requests and even their demands were also very largely responsible for bringing this award to us.

It has been said by others that Dow Corning engineers and scientists have displayed some outstanding team work. That I am proud to admit. Teamwork among groups of scientists and engineers with diverse viewpoints, skills and personalities, is essential to rapid progress in a new field such as ours. We have made a conscious effort in building our organization, and, even in the arrangement of our laboratories and offices, to ease personal contact and teamwork.

This spirit of teamwork has not stopped at our gate. It has reached out and helped to promote our work with engineers and scientists everywhere we have gone. And for this accomplishment we must credit not only the many technical people in our sales department, and in our product development laboratories in Midland, but the many scientists of all kinds who have worked with us in industry, colleges, and government agencies.

Anyone who has introduced a brand new material to the U.S. market will testify that the education of many people about that product was one of the toughest jobs they faced. In the case of our silicone products the job was different, as well as difficult, because we were introducing a whole family of diverse materials. So I must credit the curiosity and competence of industrial and technical magazine editors throughout the country for their willingness to help us with this task. No one could ask for better cooperation than they have given us. They, too, deserve a considerable share in this honor because of the effort they have made to present the facts about silicones to technical people everywhere.

Referring once again to the teamwork and education that has made this award possible, let's salute the educators who provided the team members with their basic training. Our company being only 12 years old, we have relatively few older heads in our operating organization. A great majority of our technical people were recruited after World War II. We have many very able young chemical engineers and other technical men-group leaders in design, sales, product engineering and production-who saw service in World War II and after. These young men came from about 75 different colleges and universities. We and they owe a debt of gratitude to the teachers who helped to stimulate and nurture their scientific interests, their intellectual curiosity—their ability to get along with others; all the qualities that have made them essential members of a productive and resourceful team.

So, Professor Whitman, we thank you and your distinguished committee most sincerely for having considered our new and relatively small company worthy of this great honor. And on behalf of our Dow Corning chemical engineers, our other scientists, and of all of our employees, associates, and customers, I take great pleasure and pride in accepting this 1955 Award for Chemical Engineering Achievement.



GENERAL JOHN E. HULL, former U. S. and U. N. commander-in-chief in the Far East and vice chief of staff, Department of the Army, speaks from 38 years of rich experience in a profession where leadership and teamwork really count. Here the new president of MCA appraises the 1955

Chemical Engineering Award winning achievement of the Dow Corning Corporation in terms of these two human essentials of successful industrial development. You will want to read—and re-read—these excerpts from his inspiring address at the Chemical Engineering Award presentation.

#### LEADERSHIP:

### The Key to Industrial Development

By John Edwin Hull

War is often a tender, loving nurse to some uneconomical industrial infants. But when peace comes they must quickly learn to stand on their own feet in the market place or die. What we are honoring here tonight is an unusual example of such survival.

Silicones now play a part in the daily lives of all of us. A war baby that started out with unspectacular sales of \$15,000 a month is already rolling along at a very respectable

\$2-million-a-month clip. Silicones have gained such stature that the very name helps to sell products.

While not equipped to evaluate the technical or scientific aspects of the Dow Corning achievement, I am qualified by experience and training to judge it in terms of two qualities it exhibits in a very high degree—the human essentials of any such achievement we call leadership and teamwork.

Throughout my army career this

is a subject to which I have given much study. It was my privilege to know all the senior military leaders on the Allied side during World War II as well as most of the top political leaders. I know many of the men who have succeeded to their positions since the war. And in addition, I have met and gotten to know other present-day leaders in the free world—especially in the Far East.

Although no two of these men have been alike, they all have demonstrated the qualities of leadership which they do have in common. These qualities are just as applicable in civilian life in the fields of science and industry as they are in the military field.

As I reviewed the Dow Corning story and the developments that preceded it, I could not help feeling regret that I was not personally acquainted with the men who brought it about—that I was not able to watch or, even better, participate in many of its facinating steps. Measured against all established criteria, here was a record of leadership and teamwork of very high order.

From van Helmont through Kipping, Hyde and McGregor, the fundamental researchers in this field demonstrated several very important traits of leadership common to their type and shared by all pioneers. These traits are vision, an unorthodox willingness to examine the improbable, and a dogged belief that it is possible to scale a barrier and learn what is on the other side.

#### Research by Teamwork

As I got into the more recent stages of this story, I was struck again by what appears to be largely an American characteristic of research. This is the well organized, well planned, but inspired research by teamwork, so different from the European pattern where lingering caste concepts still tend to put the main glory and responsibility on one man.

One of the obvious results of our system is that we seem to arrive at very complex results much faster.

It is no accident that the greatest number of accomplishments of this sort, and the speed of their accomplishment, are brought about through the device we call the corporation—an organization specifically and primarily designed to get the most out of the human attributes of leadership and teamwork. We see this graphically borne out in the Dow Corning developments subsequent to 1943.

Many people have the ability to recognize the potential "good bet," just as many can come up with really bright ideas. The real test shows up in ability to execute them. Where and how did leadership come into play in this instance?

• First, there was the essential ability to recognize the potential—in this case a potential that would have eluded many very capable people.

• Next, was the ability to organize people to prove out the original theories and then to carry them through to commercial success, and to organize facilities and funds.

 Third, was the ability to visualize and develop markets. In this case this is where the qualities of leadership and teamwork were most marked.

#### Leadership in Finding Markets

During the war there was no great problem in developing markets. When the war ended the real test came, especially in a case like this, where no market had existed before, to find or develop new demand.

I can visualize this as a period of potential human crisis—a time when both team members and leaders could have suffered that awful doubt, "what do we do now?" This is the time when, without leadership or team spirit, good men begin looking for other teams; leaders begin to have their time taken up by other problems, and that elusive essential to good morale, belief in what you are doing, begins to disintegrate.

At Dow Corning, obviously, none of these things happened. Its chemical-engineer-president Dr. W. R. Collings, has recounted that his group was very fortunate to be able to come up early with a highly successful mold-release compound for rubber molding products. This produced some very helpful drum-lot orders. But there had certainly been prudent planning toward that day. The team and leaders already had their new roads mapped, and knew they had their vehicles and supplies ready to travel them.

From this point on, the ability to

manage, lead and work together has been apparent at every turn. In the military organization, where nothing is so important as leadership and teamwork, we make a point of trying to determine the special qualities or characteristics of a successful leader or team. Usually one or more such qualities stand out.

In the case of Dow Corning, it is the strong recognition of the importance of people. Here you have a remarkably well-planned organization of a new corporation. Here you are dealing with the introduction of a new class of material to our economic life, which entails working with an overwhelming mass of scientific and technical data. And yet, through the whole record you never lose sight of the people, the part they played and their very human traits. You never lose sight of the fact that all this is being done, after all, by and for people.

Dow Corning isn't unique. It is one of the best examples I know, but it is above all an example of the best that has built the American chemical industry and has made ours the strongest nation in history.

#### Leaders Made, Not Born

The qualities of leadership and teamwork we see in this story give our greatest promise, our real hope, for the future. From this record I draw a moral-one which is so important that I hope I can implant it in the minds of everyone here. Leaders are not born, they are made. If you will forgive my going back once more to my experience of 38 years, this is the one great lesson from that experience. Nothing is more important in human endeavor be it the defense of our country or the building of a new industryas the development of teamwork and good leaders, and you cannot have good teamwork unless you have good leaders.

We must remember that young people are anxious to fill these roles. They will carefully watch their elders, study and work harder than many of us, and think and strive to become what we most want them to become. We have seen clearly that the kind of leadership we require if we are to see our own hopes and dreams realized, must be based on a high degree of knowledge and imagination. Therefore, we must realize that we have a tremendous

responsibility to train and help develop this new leadership. Let us not tell our young people that the burden of the future will rest on their shoulders, without first clearly understanding that their future burden now rests on ours.

We hear a great deal these days about the importance of education to our country's and our industry's future. The need for technical and scientific education is obvious, but even more important is this training for leadership. This is the best reason I know for our industry to help all it can in the field of education.

At present our colleges and universities are not turning out scientists and engineers in sufficient numbers to meet the requirements for them. It is inconceivable to me that we will not be able to correct this situation. I know we can correct it if we make the effort and this we must do. I have confidence in the future and in the leadership we will produce in this country in the years ahead.

There is another lesson to be learned from the Dow Corning story, especially for the young. I know of no field that offers more opportunity for the best in leadership and teamwork than the chemical industry this company represents. The Dow Corning story is just one of many in this industry, and continuously we see similar stories unfolding.

Any leader worth his salt demands the greatest challenge his abilities can find. Any first-rate team player wants to be on the winning, scoring team. I have always admired but never envied the captain and players on the defensive platoon of pro football teams. Greater than the rich financial rewards possible in our industry are the satisfactions which can be gained from its opportunities for leadership and winning teamwork.

As a consumer I am really grateful for the benefits these new developments have brought to my life. I take the word of the experts that this represents an outstanding chemical engineering achievement. But simply as one person, I heartily applaud the men who have brought about this accomplishment, more than the accomplishment itself. They are an inspiration to me and to all of us. These quiet, modest men are some of the most important people in the world today.



If you process pelletized, slab or sheet solids, you'll find woven-wire conveyor belts mighty useful. They're flexible; resist heat, cold and corrosives; aid gas-solid contacting.

#### J. F. REID, The Cambridge Wire Cloth Co., Cambridge, Md.

By nature, liquids and gases are mobile. Not so solids. To run them around through a processing plant calls for techniques completely different from those used for fluids handling.

Among the techniques gaining increasing favor is movement by woven-wire conveyor belts. The open mesh construction offers advantages for both wet and dry processing.

Liquid held by the solids or applied for bleaching, washing or other purposes drains freely through the open mesh of the belt without harming it in any way. Where temperature must be changed during dry processing, hot or cold atmosphere or gas can circulate freely and uniformly through the belt.

#### How They Are Built

All-metal belts can be constructed from any metal or alloy, including stainless steels. Thus, they are completely satisfactory under hot, cold or corrosive conditions. With all-metal construction, belt life is long with minimum maintenance.

Belts are woven from a series of spiraled wires that are joined together across the body of the belt. Such a spiral-loop construction makes the belt completely flexible.

Too, since the ends of the belt are joined in similar fashion to make a continuous web there are no seams, lacers or fasteners. In turn, there are no weak points in the belt; no seams or joints to mark the product.

Belts can be made in any length or width, from any metal or alloy and in a wide range of mesh openings. Standard mesh sizes range from \$\frac{1}{2}\$ in.

Many varieties of special attachments are available for the sides and surface of the belt. Examples are found in cross flights and retaining selvages to hold the product on the belt during horizontal or inclined movement.

#### Basic Weaves

Although woven wire belts are available in nine basic weaves, only six are used to any degree in the chemical process industry.

The three weaves used most frequently are the Balanced, the One-Direction and the Duplex.

Balanced belting has low ultimate cost and high tensile strength. Belt travels straight by resisting distorting strains. Its relatively high tensile strength makes it suitable for temperatures ranging up to 1,300 F. Balanced weave is available with mesh openings ranging from 2 in. down to # in.

One-Direction weave, or Sectional Belting as it is sometimes called, costs less than any other weave. Because it has only moderate tensile strength, it is recommended for light loads. It does, however, offer the advantage of controlled belt travel. Mesh sizes range from 2 in. down to 12 mesh.

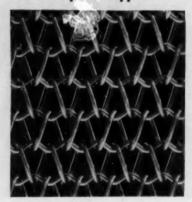
Duplex weave has high tensile strength and its close mesh provides a smooth carrying surface. Its structure might be described as comparatively dense and compact. Thus it can carry small particle-sizes, sheet or slab materials that might be marked by more open mesh weaves. Duplex mesh openings range from § in. down to 23 mesh.

The other three weaves used with some frequency by the chemical field include Corduroy, Double-Balanced and Gratex.

Corduroy belting has high tensile strength and extremely small mesh openings, down to & in.

Double Balanced weave has, generally, the same advantages as the Balanced weave and a range of

### Most Popular Types



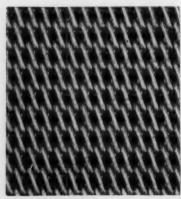
**Balanced Weave** 

High strength and economical; good for high temperatures.



**One Direction Weave** 

Moderate strength, low cost: recommended for light loads.



**Duplex Weave** 

Strong, closely woven mesh; has retentive, smooth surface. mesh sizes from 11 in. down to 22

Gratex weave also has advantages similar to those of the Balanced weave but is stronger due to the proximity of the mesh. Mesh sizes range from 2 of an in. down to 12 mesh.

Cost comparison among these six weaves is difficult and somewhat impractical because there should be no implication that any of the six are interchangeable one with another. However, to give you some idea of typical comparative costs. the table shows cost per square foot of a single specification constructed of 16 gage steel wire in each of the six weaves for belts over 50 ft.

Obviously, these are only typical costs for comparative purposes. Actual costs may vary greatly depending upon the metal or alloy used, gage of wire, weight of the belt and dimensions.

This brief discussion indicates a specific belt should be selected only with the aid of an experienced wire belt engineer. And you should supply him with complete information on all phases of the process with which you are dealing.

#### Handle Three Solid Forms

How are typical chemical processing plants now using wovenwire belts? The following examples will show you how wire belts make processing faster, continuous, more uniform and less expensive.

Pellets-One catalyst processor has installed a woven-wire belt conveyor in a drying unit between the extrusion press and calciner. Extruded catalyst is cut into suitable lengths and dropped onto the stainless-steel wire belt. The open mesh of the belt allows hot air to circulate freely for uniform drying. The all-metal belt is unharmed by constant operation at elevated drying temperature.

A manufacturer of platinum catalysts, uses a single woven-wire belt to carry his product through three processes.

In this operation, the catalyst pellets are dropped from a hopper onto the stainless steel belt. The

#### **Weave Determines Belt Cost**

Weave	Cost, \$
One Direction or Sectional, 4 mesh, alternating 12-in. sections of right and left spirals	
Balanced, Spec. B-42-38-16 Duplex, Spec. D-78-50-15-16 Double Balanced,	1.80 2.45
Spec. DB-60-46-16	2.45 2.95
Corduroy, Spec. CW-26-80-14-16	3.35

#### What specification means:

Letters-type of weave First number—turns or spirals per foot of Second number-reinforcing rods per foot

of length.

Third number—wire gage. In cases where the gage of the spiral and reinforcing rods are different, the third numeral indicates the gage of the rein-forcing rod and the fourth the gage of the spiral wire.

1 Costs based on 16 gage wire for belts over 50 ft. long.

belt dewaters the catalyst as it falls from the hopper. Then it carries the catalyst through a spray wash and not water rinse. Both solutions drain freely through the load and out through the open mesh of the

Pellets are pre-dried with a blast of hot air to prevent them from sticking together in future operations. Again, the open mesh of the belt allows free circulation of the

The same belt then feeds the washed, rinsed and pre-dried catalyst onto another belt in a drying oven, similar to that described above, operating at temperatures up to 400 F. This belt is equipped with a special selvage, known as an upturned edge, to keep the load on the surface of the belt as it moves through the dryer.

After the pellets have been dried thoroughly, they are transferred to hoppers for distribution to furnaces equipped with woven wire belts made from 25-20 alloy wire and fitted with special retaining selvages. These belts carry the catalyst through the furnace which operates at a temperature of about

Special devices, at several points along this line, free catalyst particles that adhere to the belt or that become trapped in the mesh of the belt. Loss of material is reduced to an absolute minimum, thereby.

There are many other examples of use of woven-wire belts for processing pelletized material. But, since the same advantages stated here apply elsewhere, there seems little reason to expand further. Other types of pelletized material being processed on such belts include animal and poultry feeds, pharmaceuticals, dessicants, etc.

Slabs—A manufacturer of asbestos shingles uses a short wovenwire conveyor belt to flash-dry asbestos shingles just before applying an exterior finish. This belt carries the shingles over a series of pressure gas burners. The belt, being all metal, is unharmed by the intense heat of the gas burners and its open mesh allows fast, uniform drying of the load.

This same manufacturer also uses a woven-wire belt in an oven for drying the asbestos shingles after they have been imprinted, cut and trimmed.

Another manufacturer of asbestos shingles uses a stainless-steel wire belt to carry his product through a drying oven as the last step in his processing. In this case, the shingles are sprayed with a 4% acid wash just before they are deposited on the belt. Yet, the stainless-steel belt is unharmed by the acid and provides continuous uniform drying.

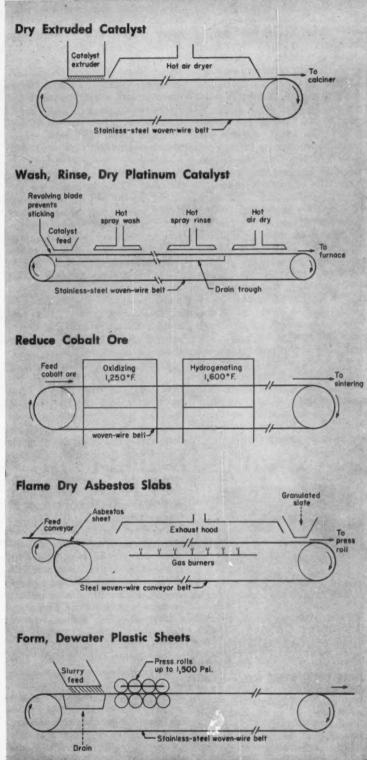
Sheets—There are many, many examples of how woven-wire belts may be used for carrying sheet materials through operations such as washing, drying, dewatering, curing, etc. Here are just a few.

In one plant, a battery of dryers, each equipped with over 1,200 ft. of 72-in. woven-wire belting, dries synthetic rubber continuously.

Another processor uses wovenwire belts under extremely rigorous conditions for forming and dewatering continuous sheets of plastic. The woven-wire belt collects the flakes of plastic from a slurry and carries them beneath a squeeze roll to form a continuous sheet and press out the water.

Although pressure on the squeeze roll is approximately 1,500 lb. the





all-metal belt stands up well. The open mesh, of course, provides free drainage of the slurry water as the plastic flakes are pressed into a continuous strip.

In another plant, a stainless-steel woven-wire belt carries an extruded plastic sheet through a continuous curing process employing a saline solution, followed by a series of spray washes and a low-temperature drying cycle. All are performed on woven-wire belts. From previous descriptions, the advantages of the all-metal, open-mesh construction of the belt are obvious for this installation.

Still another application involves the use of pressure rolls to exert only enough pressure to maintain very uniform thickness of the material being processed.

A fibrous mat of material is conveyed by the woven-wire belt through a series of washing operations. Thickness of the mat is controlled by pressure rolls mounted inside the wash unit. Special supports are installed beneath the belt at the points where the pressure rolls control the thickness. In this case, the belt was fabricated with almost microscopic accuracy since any variations in width or thickness of the belt would change thickness of the mat.



JOHNSTON F. REID, Manager, Belt Department, The Cambridge Wire Belt Co., has published many articles dealing with wire belts. Mr. Reid joined the company in 1942 as a territory representative. In 1944 he became Assistant to the Manager of Belt Department, and Manager in 1947.

Another process is the production of rayon fiber from wood pulp. After the pulp has reached the stage where it is a continuous blanket, it must be sprayed with solvents to eliminate the sulfur content. Then it must be washed, bleached, washed again and, finally, sprayed with a fluid to soften the fibers for spinning.

Woven-wire belts are used in all of these steps. The belts are of stainless steel with an edge 4-in. high.

The rayon blanket lies flat on the surface of the belt between the edges. As the belt and the blanket pass through the various process cycles, press rollers compress the blanket and force the moisture out.

This belt is made of an especially durable weave and metal due to its constant operation under these severe conditions. Both its allmetal construction and the open mesh are important features in providing durability and free drainage of process solutions during these continuous operations.

There are a great many other instances of specific processes being performed with the aid of a woven-wire belt. Among them is the reduction of cobalt prior to sintering. In this instance, a single belt carries the cobalt ore through a combination oxidizing and hydrogenating process. The oxidizing step involves temperatures of 1,250 F. while the hydrogenating process operates at higher 1,500 F. temperatures.

The open mesh circulates both atmospheres freely and the allmetal construction is unharmed by either. It is interesting to note that the belt apparently develops a heavy oxide coating in the first cycle that protects it from scaling thereafter.

Obviously, not all woven-wire belts in the chemical process industries operate under such rigorous conditions as these. One long standing use of a wire belt is on bagging lines for cement and other powder materials.

This should not be termed a process conveyor because the primary purpose of the belt in this case is to remove the filled bags from the loading and weighing machine. Many manufacturers, however, have found the woven-wire belt extremely useful for this purpose since the open mesh of the belt allows spilled material to sift through into salvage troughs mounted below the belt.

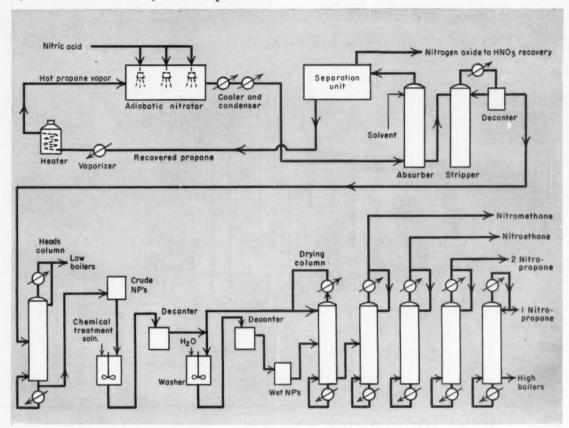
Because spillage does sift through, the surface of the belt does not become caked and deteriorate. In addition, the all-metal belt has much longer life than rubber or canvas belts.

As a specific example, one manufacturer was paying maintenance and replacement cost of over \$1,000 a year for a system of rubber belts carrying bagged fertilizer from filling machines to freight cars. Four years ago he replaced the rubber belts with a very simple wire belt costing one-fourth as much.

He has not paid a single penny for maintenance, replacement, or material losses since the changeover. Total savings amounted to more than 40 times the cost of the wire belt in the 4-year period.

Still another example of the costsaving capabilities of woven-wire belts comes from a wool processor. The original system involved a device that broke frequently and cost the processor many thousands of dollars in lost production time and labor cost. This manufacturer switched to woven wire belts which cost four times more than the previous system. Within a year, the woven wire belt paid for itself. Shut-down due to breakdown was eliminated. The woven wire belt even boosted production 25% over the previous system.

From these few examples, you can see why processors are finding woven-wire belts a good tool for continuous processing. However, you should know that it is not a matter merely of ordering "one woven-wire conveyor belt". Conditions under which the belt is to be used, the type and weight of load it will carry, and many other factors must be studied carefully before a specific belt can be selected. And in addition to specifying the proper metal or alloy, you must select the specific weave to best fit the job.



# Keys to a New Chemical Kingdom

The vastly promising nitroparaffins are now in commercial production because chemical engineering resourcefulness was a match for massive problems in equipment design, corrosion and process control.

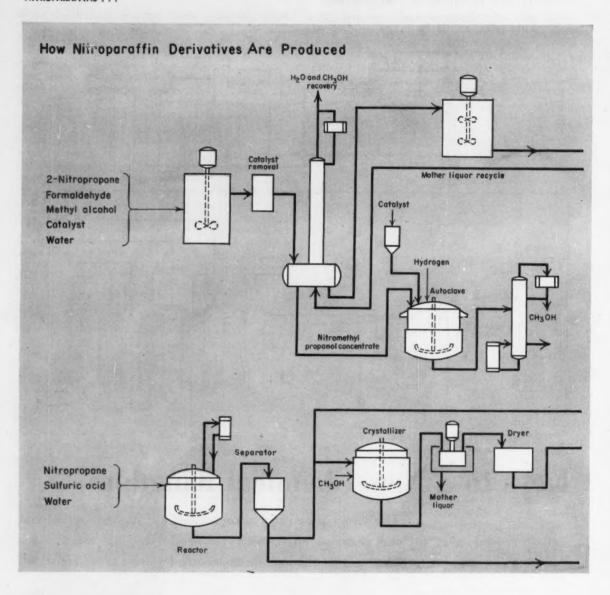
Commercial Solvents Corp. engineers spent 20 years in traversing the long, intricate corridor between the laboratory invention of vaporphase nitration and the 10-million-lb-per-yr. commercial plant for nitroparaffins recently put on stream in Sterlington, La. A continual succession of locked doors—problems in equipment design, materials of construction, process instrumentation and product quality control—barred the way. Now, largely through chemical engineering, they have all the keys to what promises to be a new chemical kingdom.

Produced on a small scale since

1940 at a CSC pilot plant in Peoria, Ill., the nitroparaffins and their derivatives have already created a demand for their services in such industries as agriculture, textile, rubber, petroleum, paint, automotive, drug and cosmetic. The nitroparaffins themselves are unusually good solvents, fuels and propellants. As intermediates, only a token of nitroparaffin versatility is offered by the 2,000 derivatives laboratory-produced thus far by Commercial Solvents.

In the variety of reactions the family will readily undergo, it resembles a textbook case. When hydrolyzed with mineral acids, the primary isomers (e.g., nitromethane and 1-nitropropane) form fatty acids and hydroxylammonium salts. Reduction with alkali and metals yields amines. Condensation of aldehydes with primary and secondary nitroparaffins yields either nitroalcohols or nitroolefins, depending on conditions. Acid reduction of the nitroalcohols yields aminoalcohols.

The commercial process which opens this rich territory for development is diagrammed above. It centers around an adiabatic nitrator which uses the heat of the



nitration reaction to vaporize nitric acid fed through multiple spray nozzles.

Facilities have also been provided for converting a considerable proportion of the nitroparaffins to derivatives, primarily 2-amino-2-methyl-1-propanol, 2-amino-2-methyl-1, 3-propanediol, and tris (hydroxylmethyl) aminomethane, hydroxylammonium sulfate, hydroxylammonium acid sulfate and the Alkaterges. Flow diagrams for making typical derivatives produced at Sterlington are shown above.

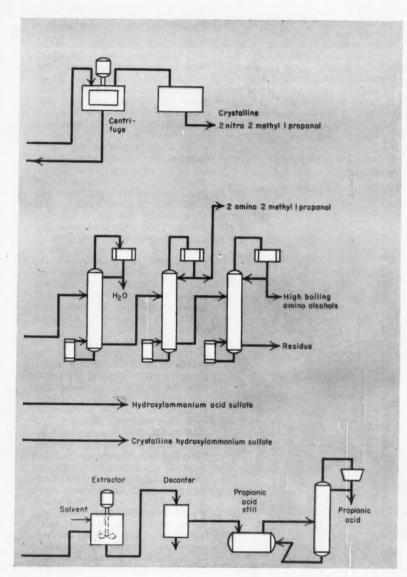
To bring nitroparaffin production to this commercial fruition, CSC engineers have put to use practically all the chemical engineering unit operations. They had to design equipment for: vaporizing nitric acid under pressure; reacting nitric acid vapors with hydrocarbons at high temperatures; recovering nitric oxide and unreacted hydrocarbon from the nitration gases and recycling them to the process; recovering, purifying and separating the mixture of nitroparaffins produced; and making derivatives

therefrom. And throughout the development story, the necessity to control corrosion and to control the process itself looms large.

Here are some of the specific problems CSC faced and the engineering keys fashioned for their solution.

#### **Equipment Design**

The idea of using an adiabatic nitrator solved two serious heat transfer problems by utilizing the heat of reaction to vaporize the feed



nitric acid. But the high temperatures (750-850 F.), the reaction times (0.1-5.0 sec.) and the corrosiveness of nitric acid created some serious design problems.

Originally, two different solutions were worked out for trial. In the successful one, a number of small pressure nozzles served to spray liquid nitric acid into a stream of heated hydrocarbon in small increments. The other utilized a fluidized bed of inert solids to transfer the heat of reaction from the nitration zone to the vaporization zone.

Both acid-spray and fluid-bed nitrators were thoroughly evaluated in the Peoria developmental plant.

The spray-type adiabatic nitrator proved to be not only cheaper to construct, but also to have operating advantages. However its design, too, posed some unusual problems. For example, no standard spray nozzle was satisfactory for introducing the liquid acid into the reactor. A cooperative study by the company's engineers and a nozzle manufacturer resulted in satisfactory designs utilizing new alloys

and new manufacturing techniques.

Not only nitration proper, but raw material recovery and product separation steps offered their own brands of puzzlers. Extensive research on propane recovery was necessary to uncover safe procedures for handling trace byproducts in the nitration gases which could react to form unstable products. Traces of tarry material gradually built up in the propane recovery system and, in the recovered nitric acid, oxalic acid formed. The causes of these undesirable side reactions were ascertained and steps taken to avoid them.

Ways had to be found to stabilize crude nitroparaffins (containing aldehydes, alcohols, esters, nitriles, acids) and thus to prevent side reactions and decomposition during subsequent separation steps. Along with the instability came the corrosiveness of the crude nitroparaffins; this was also alleviated to a large extent.

Between 1949 and 1951, enough kinks were worked cut of the process and equipment at the Peoria developmental plant to make it possible to take full advantage of the capacity of the new nitrator and thus approximately double nitroparaffin output.

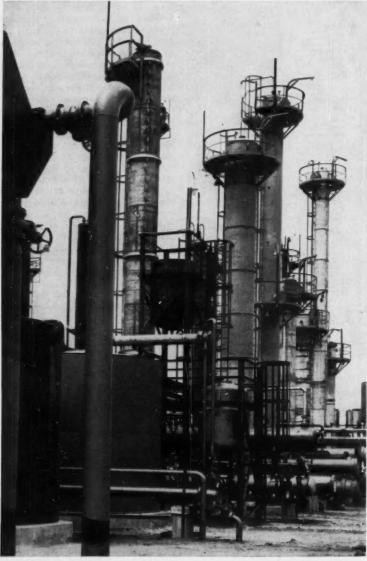
Major chemical engineering achievements scored in connection with the derivatives plant involved: evolution of safe procedures for handling Raney nickel, a pyrophoric catalyst, including its reactivation and recycle; purification of byproduct hydrogen to avoid poisoning of hydrogenation catalysts by trace impurities; prevention of formation of high-boiling byproducts during the reduction of nitrohydroxy compounds; purification process for the crude organic acids produced as a byproduct of the reaction of nitroparaffins with strong acids to produce hydroxylammonium salts.

#### **Corrosion Control**

No standard alloy gave the exact combination of corrosion resistance and physical properties needed for much of the equipment—for example, the nitrator's spray nozzles. CSC worked with metallurgists of suppliers to develop serviceable new alloys.

Chemical treatments, rather than new materials of construction, answered the corrosion problems in some cases. For example, the tendency of stainless steel to catalyze oxidation reactions, which competed with nitration, was combated by the development of a continuous deactivation treatment.

The corrosiveness of the nitroparaffins to steel and the gradual development of color during storage were found to be caused by extremely small quantities of highly colored impurities. Many possible methods for eliminating these trace impurities, or their precursors, were studied before a satisfactory chemical treatment was found. The chemical purification process eventually developed involved a slow chemical reaction between two immiscible liquids. This purification treatment necessitated a study of the relative effects of reaction rate and type and degree of agitation, together with the application of these results to equipment design. To confirm laboratory and pilot results, accelerated and long-term storage and shipping tests were



RECOVERY section for unreacted material gives reusable nitric acid, propane.

#### **Process Control**

CSC developed automatic control techniques for nitration, reactant recovery and product separation. Because optimum conditions for nitration lie in a narrow zone between essentially no reaction and predominantly oxidation reactions, control methods to hold the process to these conditions were essential.

The control panel at Sterlington contains over 100 miniature recorders and controllers. It is supplemented by a console-style multipoint temperature installation and a data reduction system to provide at a central location a complete record of operating conditions. The data reduction unit continuously scans 70 key temperatures and at preset intervals types out on the plant log these data. If at any time the scanner senses a deviation from one or more control points, it will immediately type out these data and notify the operator by means of an alarm.

In addition to temperature, the more important variables in the operation of any particular vaporphase nitration process are: mole ratio of reactants, exposure time and pressure. There is an optimum temperature for the nitration of each hydrocarbon. However, the total yields of nitro compounds remain fairly constant if reaction time and temperature are matched carefully at a particular pressure and mole ratio of reactants. Temperatures below the optimum result in incomplete nitration, whereas at higher temperatures oxidation\* and decomposition become excessive. The organic products obtained from competing reactions are alcohols, aldehydes, ketones, carboxylic acids olefins, nitrites, nitroso compounds, nitro-olefins and polymers, carbon monoxide and carbon dioxide.

In addition to the direct process controls already mentioned, the panel at Sterlington provides level indications for all tanks, alarm lights and start-stop switches for all motors in the plant. The panel switches are paralleled by switches at each motor installation. Special instrumentation includes an infrared analyzer on the nitric oxide stream, hydrogen analyzer on the autoclaves and a mass spectrometer for nitroparaffin analysis.

<sup>\*</sup>Vapor-phase nitration is intimately related to controlled oxidation of saturated hydrocarbons with oxygen in the gas phase.

### What You Can Expect Computers to Do

Simple Problem: Calculate 20,000 temperature-time points for prelimi-

nary design of a heat exchanger.

Digital computer: Requires 30 hr. setup time, 30 hr. machine time. Rental cost \$150, personnel cost \$600. Accuracy ± 0.1%.

Best desk method: Perhaps 400 engineering manhours required. Personnel cost \$4,000 including overhead. Accuracy  $\pm 1\%$ .

Complex Problem: Analyze the temperatures for a flow reaction in an experimental reactor. Get two acceptable solutions.

Digital computer: Requires 32 scientific manhours to set up two programs of 134 and 136 commands respectively. Personnel cost \$1,000 Time to get one answer only 33 minutes. Second program run in less than two hours.

Best desk method: Economically unfeasible.

## **Computer Solves Heat Flow Problems**

Here's a case study report on how digital computers were put to work on chemical engineering calculations. You may be able to use this method for profitable solutions to your own problems.

#### CHARLES A. LEVINE and ASCHER OPLER, Bow Chemical Co., Pittsburg, Calif.

Few problems confront chemical engineers more often than those that involve heat transfer. Their successful solution depends on both the engineer's familiarity with available methods of solution (tables, charts, graphs, analogs and numerical methods) and the simplicity of the problem.

With today's complex process units—and the increased emphasis on economy and efficiency—a look at the relatively new computer approach to solving heat transfer problems is definitely called for. Digital computers can save time, manpower and money. They can

help solve the hitherto "unsolvable" problems where estimates have been used to replace accurate solutions.

In the analysis of relatively simple systems, computers permit the selection of optimum design or operating conditions with less time expended than by using hand calculations. For the engineer who designs really difficult complex units, such as nuclear reactors, the digital computer offers what may be the only practical method of solution.

The purpose of this article is to describe some of the steps you'll have to go through to translate heat transfer problems into computer programs.

#### ABOUT OTHER METHODS

To appreciate fully the role that computers can fill, we'll first review some of the other methods that we have for solving heat transfer problems.

We know of three ways to transfer heat:

- By conduction.
- · By convection.
- · By radiation.

This article will exclude radiative heat transfer. Although considerable progress in using computers has been made in this field, the subject is not of prime interest to most chemical engineers. Let's consider conduction and then, convection.

#### HEAT TRANSFER BY CONDUCTION

In principle, it's quite easy to solve heat conduction problems. One merely solves the basic equation (due to Poisson),

$$\frac{\partial T}{\partial t} = \frac{\partial}{\partial x} \left( \alpha_x - \frac{\partial T}{\partial x} \right) + \frac{\partial}{\partial y} \left( \alpha_y - \frac{\partial T}{\partial y} \right) + \frac{\partial}{\partial z} \left( \alpha_z - \frac{\partial T}{\partial z} \right)$$
(1)

where T is temperature; t is time; x, y and z are coordinates; and a is the thermal diffusivity. The complications may arise in selecting the appropriate physical constants and the proper initial and final conditions for the basic equation.

Practically speaking, this is not so simple. Solutions to this differential equation are known only for certain simplified cases. If our problem happens to fit—or approximate—one of these special forms, we can consult the proper table or chart and use previously determined solutions.

If our problem does not fit, we are forced to attempt our own solution. But before we do this, we can often improve the situation by

simplifying the basic heat flow equation as far as possible. When a material is sufficiently homogeneous, we may safely assume that the thermal diffusivity is the same in all directions. And if we further take the diffusivity as invariant with temperature (roughly true for some materials over small ranges), the equation reduces to:

$$\frac{\partial T}{\partial t} = \alpha \left( \frac{\partial^3 T}{\partial x^2} + \frac{\partial^3 T}{\partial y^3} + \frac{\partial^3 T}{\partial z^2} \right) \qquad (2)$$

When there is some symmetry to the shape of the system under consideration, the three dimensions may be reduced to two, or even one in some cases.

$$\frac{\partial T}{\partial t} = \alpha \left( -\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} \right)$$
 (3a)

$$\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial r^2} \tag{3b}$$

#### BOUNDARY CONDITIONS

For steady-state problems ( $\partial T/\partial t$  given as zero), exterior conditions remain constant with time. However, for the more general case, we need to know the interior temperature distribution at some initial time and also the time rate of change of the exterior.

If the boundary conditions are fairly simple and if the equation can be reduced to either Eq. (3a) or Eq. (3b), we may solve the problem mathematically. The method requires considerable familiarity with partial differential equations, with Fourier series and with Bessel functions.

In addition to the mathematical solutions, graphical solutions are sometimes possible. These apply only to the simplest cases and are relatively time consuming.

#### WHAT ABOUT ANALOG COMPUTERS?

Fortunately, such analytical and graphical solutions are not the only ones available. One possible alternate is the use of analog computers. While these are very useful devices and are becoming more widely available, their use in heat transfer problems is limited to the simplest cases.

Even when analog computers can be used, we can get only rough temperature profiles using a reasonable amount of equipment. A few elaborate, special-purpose heat flow analogs have been built; but they are limited in their applicability and availability.

#### CALCULUS OF FINITE DIFFERENCES

The last of the available methods is the one that is most pertinent. This is the application of numerical methods based on the calculus of finite differences. (The calculus of finite differences is the discrete-interval counterpart of the calculus

#### Numerical Methods for Heat Conduction Calculations

Method & Applicability	Principle of Method	Computer Required	Recommended For	Error
Mediod & Applicability	Frinciple of Method	Computer Required	Recommended 1 of	Litor
Simultaneous difference equations, steady and unsteady state.	One equation for each unknown temperature. Solution of the set gives all temperatures.	High-speed computer. Usually, large storage capacity, but this can be reduced by using shortcuts.	Simple or intermediate problems, especially where steep gradients are encountered.	Method least sensitive to errors of rounding off and interval size.
Successive approximation by repeated interpolation, steady and unsteady state.	Assume a trial solution. Recalculate proper tem- peratures by interpolation. Smooth results until no change occurs.	Punched-card machine or intermediate computer recommended according to magnitude of problem.	Most problems, although other methods may be faster or more accurate for any given case.	Moderately sensitive to errors of rounding off and interval size.
Extrapolation, explicit solution, unsteady state only.	From temperatures at t, calculate temperatures at t + 1. Keep intervals below the critical size.	Any computer, including simple punched-card machines will do. Minimum speed and storage needed.	Simple heat flow prob- lems with regular geom- etry and smooth gradients.	Highly sensitive to interval size, moderately to rounding error. Large intervals may give unstable solution.
Monte Carlo method, steady and unsteady state	Repeated "games" start at point whose tempera- ture you want. Follow "rules" and the "score" approximates correct temperature at the desired point.	Highest-speed machines since number of games may run from 10 <sup>4</sup> to 10 <sup>7</sup> . Modest storage capacity,	Three-dimensional unsteady-state problems, unusual or irregular boundaries. Especially attractive when only a few points are required.	Basically a very large error, reduced as square root of the number of games. One extra significant figure requires 100 times the number of games.

using infinitesimals with continuous variations.)

Some of these numerical methods have been known for many years. Only recently, with developments in the use of digital computers, have they become of value to the process design engineer.

In going to finite difference methods we substitute discrete steps for continuous variation in time, temperature and distance. At first glance, this seems to be a crude substitute. But if the intervals are taken sufficiently close together, we may improve our approximation of the continuous to any desired degree.

Use of these numerical methods does not require computing machines. The methods have been used in hand and desk calculation for some time. However, as the physical system and the boundary values become more complex, the amount of work required becomes more prohibitive.

#### THE COMPUTER PROGRAM

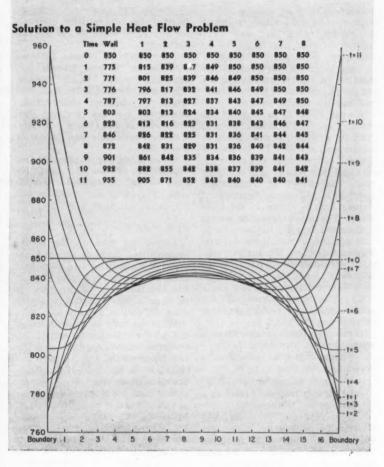
The translation of a heat flow problem to a computer program requires cooperation between engineer and mathematician. There are a number of different numerical methods available and the selection of the appropriate one depends on the engineer's requirements and the computing machine's capacities.

We have shown some of the relative advantages and disadvantages of these numerical methods in the summary table on p 204.

In conjunction with selecting a method, the size of the finite difference step in time and in space must be set. If the step is too large, the solution will be entirely incorrect or, at best, a crude approximation to the true situation. If the interval is too small, the computing time and machine capacity requirements may be too high to be practical.

We'll try to illustrate the principles involved in computer programming in the two practical examples below. They represent two extreme situations. Each was helped by computer application.

In the first case a computer was used on a simple problem and many solutions under a wide variety of conditions were possible. The other example represents a vastly more complex problem. In this case a very high-speed computer obtained only two solutions.



#### Problem 1

A problem arose in connection with the preliminary design for a heat exchange unit working on an intermittent cycle. Since several different cycle lengths, various materials of construction and a number of different physical configurations were all under consideration, what we wanted was an overall view of the behavior of such heat exchange units.

The properties of the materials and the physical laws were well understood. Therefore, the computer route was chosen in preference to the experimental.

Because of the symmetry of the situation, we could use the simplest one-dimensional unsteady state equation to describe the temperature-time relations. The total range of temperatures was known to be sufficiently small that the

effect of the change of thermal diffusivity with temperature would be negligible.

We changed Eq. (3b) into the working finite difference form

$$T_{s, t+1} - T_{s, t} = k [T_{s-1, t} + T_{s+1, t} - 2T_{s, t}]$$

where k is a lumped constant equal to  $a\Delta t/(\Delta x)^s$ ; and  $T_{s,t}$  is the temperature at coordinate x and time t.

To solve the equation for each temperature, we used a simple IBM punched-card machine. This machine, the 602-A, is programmed by plugging wires into a control panel. In the particular arrangement which we devised, the machine stored the initial temperature distribution and k as read in on a single card. Following this, we replaced the calculating panel and stacked unpunched cards in the hopper of the machine.

The computer performed the cal-

culation for each position, punched the results on a card and then "moved to" the next point to be calculated. This process continued as long as cards were fed to the machine. After the calculation, we put the punched cards in a tabulator and had the results printed.

We can show an example of the results as the machine printed them for a particular case. Consider a brick wall at 850 F. In the process the wall is first cooled at a changing rate and then heated at a changing rate. The change of temperature along the wall as a function of elapsed time is shown in the table above. The figure shows the results in the more familiar isotherm form.

In addition to variations in initial temperatures and the lumped constant, considerable variation in the boundary condition was possible with this setup.

By suitable adjustment of the control panel we could use these varations:

• Remove heat or add it at a constant rate.

• Remove heat or add it at a preset variable rate.

· Operate adiabatically.

 Maintain the boundaries at a constant preset temperature.

In studying our proposed unit, the machine calculated about 20,-000 temperatures. This required approximately 30 hours of machine time and 30 hours of setup time.

We obtained the best compromise between speed and accuracy when k was taken between 0.3 and 0.1. Setting k automatically fixes the

relative time and position intervals for any given value of the thermal diffusivity.

The numerical results that we obtained on the heat transfer unit are unimportant in themselves. What is of interest is the ease with which we obtained abundant information for the proposed unit under the widest variety of construction materials and operating conditions.

We obtained our results with less expenditure of time and manpower than we had anticipated. And the cost of renting the machine was somewhat less than \$150.

#### HEAT FLOW BY CONVECTION

Before we take up the second example, we ought to consider the topic of convection. As with heat transfer through solids by conduction, the convective problem in fluids is simply stated but is even more difficult to solve.

What we need is the solution of a set of simultaneous partial differential equations that describe the temperature and velocity distribution of the fluid. Since these are related by viscosity, they are highly interdependent.

The solution of such simultaneous equations has rarely been carried out. Therefore, hopes for the direct approach were abandoned early in engineering history. As a substitute, the principle of similarity—using dimensionless groups and empirical observations—has been highly developed. However, this approach often falls far short of the

desirable confidence and accuracy.

With computers available that have high speed and accuracy, it is now reasonable for us to go back to first principles to solve the simultaneous equations of heat convection.

#### Problem 2

We solved a difficult heat flow problem using this route and an IBM 701 Electronic Data Processing Machine. The problem involved streamline flow of a reacting fluid through an experimental reactor. Because of certain characteristics of the system, it appeared that an extensive bench-scale study would be difficult and expensive.

Consequently, management decided to start with a mathematical analysis of the reactor to test the feasibility of several proposed de-

sions.

We made arrangements with the New York Scientific Computing Service of IBM to run the problem on their 701 computer. After working out a method of solution on the 602-A computer, the principles evolved were used in drawing up a program for the 701.

We used a simplified method of machine instruction called Speed-coding and wrote a satisfactory program in a couple of days. After a short error-detection run, we fed the amended program to the 701 and obtained a completely satisfactory solution in 33 minutes.

A second program involving three simultaneous partial differential equations (see discussion above) was run in less than two hours. These two programs required the writing of only 134 and 136 commands respectively. The machine rental cost was less than \$1,000 and probably no more than that was spent in the planning and programming stages.

#### COMPUTERS DO HELP

Our experience bears out what others are finding at widespread computer-aided organizations. Computers can help speed up heat transfer calculations. They can lead to better and more accurate prediction of the design and performance of complex units.

#### ACKNOWLEDGEMENT

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### **Chemical Engineering Fundamentals**

## Reactor Design for Complex Reactions—I

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IN OUR last three installments (Chem. Eng., Oct. 1955, p. 211; Nov. 1955, p. 217; and Dec. 1955, p. 211) we discussed the effect of temperature, pressure and backmixing on the reactor volume-or holding time-for the case of simple reactions.

This month we shall discuss similar effects on parallel and series reactions. For convenience of grouping we can consider parallel and series reactions under the heading of complex reactions.

The most important difference between complex and simple reactions is that the reaction variables affect the product distribution as well as holding

There are many complex reactions where the product distribution is much more important than the reactor volume. A system of equations, given below, allows the calculation of product distribution only. Eliminating holding time from the equations greatly simplifies the mathematics.

This is useful when the rate equations are too complicated to integrate or to work with if both holding time and product distribution must be considered.

#### Parallel Reactions: More Than One Product

In an industrial reactor, usually more than one reaction takes place at one time. And an unwanted byproduct is often formed in the reactor along with the desired product.

Parallel reactions are those in which more than one product is formed by separate reactions and where the products, once formed, do not react again. Typical parallel reactions are those that can be written as

$$\begin{cases}
A \to R \\
A \to S
\end{cases} \qquad
\begin{cases}
A + B \to R \\
A + C \to S
\end{cases}$$

$$\begin{cases} A \to R \\ A + B \to S \end{cases}$$

In none of these three combinations do any of the products undergo further reaction.

We'll use the simplest kind of parallel reaction, where A goes to both R and S, as our example in discussing the effect that changes in process variables may have on parallel reactions. The basic rate equations for this reaction are very similar to those of the simple reaction. We can write these general equations as follows:

$$dC_R/dt = k_1C_A^n$$
  
 $dC_S/dt = k_2C_A^m$   
 $-dC_A/dt = k_1C_A^n + k_2C_A^m$  (1a)

If the reactions are both the same order (i.e., if n is equal to m) then we can write

$$dC_A/dt = -(k_1 + k_2) C_A^n (1b)$$

And if both reactions are first-order reactions, then

$$C_A = C_{Ao}e^{-b}$$
 (2)  
 $-C_{Po} = [k_1/(k_1 + k_2)][C_{Ao}(1 - e^{-b})$  (3)

$$C_R - C_{Ro} = [k_1/(k_1 + k_2)] [C_{Ao} (1 - e^{-b})$$
 (3)  
 $C_S - C_{So} = [k_2/(k_1 + k_2)] [C_{Ao} (1 - e^{-b})]$  where  $b = (k_1 + k_2)t$ 

These equations are similar to the first-order equation for the simple reaction

$$A \rightarrow R$$

except that we now have two products. R and S are



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#### Nomenclature (Consistent Units)

A. B. C	Reactants
b	$(k_1 + k_2)t$
CA, etc.	Concentration of A, etc.
CAo, etc.	Initial concentration of A, etc.
d	Differential operator
e	2.7183
F	Feed rate
k1, k2	Rate constants
m, n	Order of reaction
P	Substitute for k, in Eqs. (8), (9) and (10)
	Substitute for k2 in Eqs. (9) and (10)
q r	Reaction rate
R, S	Products
t	Holding time
V	Volume
x	Degree of conversion
	k./k

related by the simple ratio of the rate constants that appear in their respective rate of formation equations,

$$(C_R - C_{Ro})/(C_S - C_{So}) = k_1/k_2$$
 (5)

The case where each reaction is of a different order has not been integrated and may well be too complicated to be integrated into a form that can be used by chemical engineers.

#### Effect of Temperature

Since parallel reactions are the sum of two simple reactions, the effect of temperature is the same as for simple reactions. However, note that if either  $k_1$  or  $k_2$  increases much more rapidly with temperature than the other, a higher temperature will increase the yield of the particular product formed by that reaction.

Thus, if R is the desired product, the best yield is obtained by raising the temperature if  $k_1$  has the higher temperature coefficient; or by lowering the reaction temperature if  $k_2$  has the higher temperature coefficient.

If the temperature is lowered, the rate of each reaction is slowed considerably. This requires that a larger reactor volume be used. Then the problem becomes an economic balance between product yield and reactor cost.

#### Effect of Pressure

The effect of pressure is very similar to the case of the simple reaction. If the reaction is in the liquid phase, the only effect of pressure is the indi-

A<sub>0</sub>,R<sub>0</sub>,S<sub>0</sub> A,R,S Fig.1

rect one due to volatility of either products or reactants.

For a gas-phase reaction the effect of pressure is to increase concentration. If the reactions are both first order (or equal order, i.e., n=m), increased pressure will increase the rate of reaction but will not affect the product distribution.

If the orders of reaction are different, an increase in pressure will favor the reaction of higher order and increase the yield of reactant formed by that reaction.

#### **Effect of Recycling Product**

Since the reactions are both irreversible, the recycle of either R or S will not suppress the formation of the one that is recycled. Recycle of either product will dilute the reactants and lower the reaction rate.

If the orders of the reactions are the same for the formation of either product, the diluent will affect both reactions to the same degree. If the reactions are of different orders, the reaction of highest order will be retarded more by the recycle of either product. Therefore, for the system

$$A \xrightarrow{k_1} A \xrightarrow{} R$$
  $dC_R/dt = k_1 C_A^2$   
 $k_2$   
 $A \xrightarrow{} S$   $dC_S/dt = k_1 C_A$ 

the yield of S can be increased by recycling S or R, which lowers the concentration of A in the feed to the reactor.

#### Effect of Catalyst

Ordinarily we think of a catalyst in terms of conversion. In the case of a simple reaction, the only effect of catalyst addition is to speed up the reaction and either allow us to use a smaller reactor than we'd need without catalyst, or allow the reaction to take place at less severe conditions of temperature and pressure.

Actually, one of the major functions of a catalyst is that of selectivity—the ability of the catalyst to increase the yield of one reactant at the expense of the other.

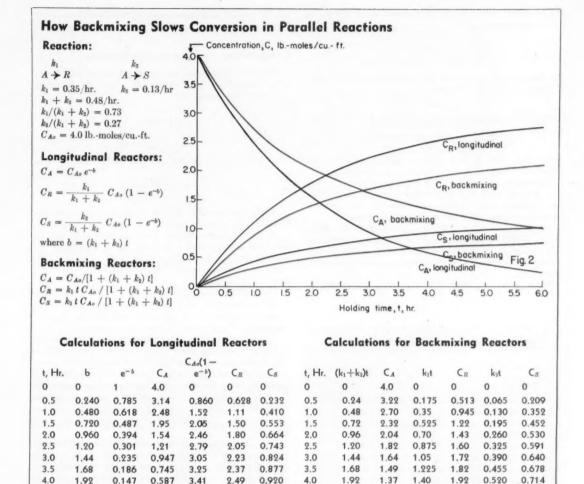
In the case of parallel reactions, the important effect of a catalyst is to increase either  $k_1$  or  $k_2$  to a greater degree than the other, depending on whether R or S is the desired product. Where R is the desired product, for example, and S is valueless, a catalyst can usually be found that increases the yield of R by increasing the ratio of  $k_1$  to  $k_2$ .

And this is more effective than varying conditions of temperature, pressure or product cycle.

#### What About Backmixing?

When we discussed the effect of backmixing on simple reactions (*Chem. Eng.*, Oct. 1955, p. 211; and Nov. 1955, p. 217) we were concerned only with the effect of backmixing on the size of the reactor or on the holding time.

For complex reactions there are two things to consider. One is the effect of backmixing on the reactor volume and the other is the effect of backmixing on the product distribution.



In the case of parallel reactions of the general type

0.460

0.363

0.286

0.225

3,54

3.64

3.71

3.77

2.58

2.66

2.71

2.75

0.960

0.983

1.00

1.02

4.5

5.0

5.5

6.0

2.16

2.40

2.64

2.88

1.26

1.10

1.03

1.175

$$\begin{cases} A \to R \\ A \to S \end{cases}$$

backmixing does not affect the product distribution. This can be shown quite easily by comparing equations for backmixing with those for reactions that are carried out in longitudinal flow reactors.

#### Effect of Backmixing on Over-All Rate

4.5

5.0

5.5

6.0

2.16

2.40

2.64

2.88

0.115

0.091

0.071

0.056

The equation for backmixing can be derived for complex reactions in the same manner that we derived equations for simple reactions.

Let's consider a material balance for the system shown in Fig. 1 on p. 208. For first-order reactions the material balance on A is given in these equations:

1.575

1.750

1.925

2.10

1.98

2.06

2.12

2.16

0.585

0.650

0.715

0.780

0.737

0.764

0 785

0.803

$$\begin{aligned} FC_{Ao} &= FC_A + [V (k_1 + k_2) C_A] \\ C_{Ao} &= C_A + [(V/F) (k_1 + k_2) C_A] \\ C_A &= C_{Ao}/[1 + (k_1 + k_2) (V/F)] \end{aligned}$$

or in terms of the holding time, we can write

$$C_A = C_{Ao}/[1 + (k_1 + k_2) t]$$
 (6)

Note that this is the same as the backmixing equation that we derived for the simple reaction

$$A \rightarrow R$$

except that  $(k_1 + k_2)$  replaces k.

#### **Backmixing Does Not Change Distribution**

Let's use the material balance on R and S to find

the product distribution. A balance on R gives us these equations:

$$FC_{Ro} + Vk_1 C_A = FC_R$$
  
 $C_{Ro} + k_1 (V/F) C_A = C_R$   
 $C_R - C_{Ro} = k_1 (V/F) C_A$ 

By analogy we can write the rate equation for the formation of S as follows:

$$C_S - C_{So} = k_1 (V/F) C_A$$

Then, if we divide one rate equation by the other, we get

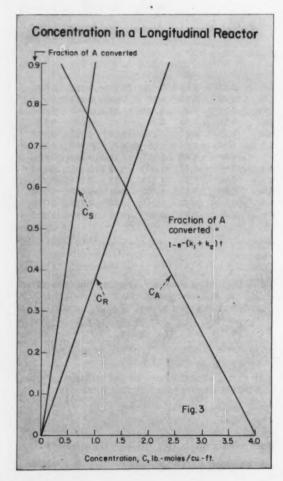
$$(C_R - C_{Ro})/(C_S - C_{So}) = k_1/k_2$$
 (7)

Note that this is the same equation as Eq. (5) which we derived for a longitudinal reactor.

Therefore, from Eq. (5) and from Eq. (7) we can deduce that for first-order parallel reactions, the product distribution—or yield of the desired product—is not affected by the reactor shape.

We will find later that this is not the case with either series or series-complex reactions. Therefore, the variation in reactor shape might serve as one means for distinguishing between parallel and series reactions.

Note, however, that if the reactions forming R



and S are of different order, this is not true even for parallel reactions.

#### Longitudinal vs. Backmixing Reactors

To show a comparison of longitudinal and backmixing reactors, we'll work out a specific example. Consider the reactions

$$\begin{cases} A \to R \\ A \to R \\ A \to S \end{cases}$$

where the values of the reaction rate constants are given as

$$k_1 = 0.35/\text{hr.}$$
  
 $k_2 = 0.13/\text{hr.}$ 

Assume also that the feed is pure A at a concentration of 4.0 lb.-moles/cu.-ft.

As our solution to the problem we would like to show a concentration history of  $C_A$ ,  $C_B$  and  $C_B$  plotted against the holding time in the reactor. We'll work out values with holding time varying from zero to six hours.

In addition, we want to work out the values for both longitudinal and for backmixing reactors in order to evaluate the effect of backmixing on conversion.

Fig. 2 on p. 209 is a plot of concentration vs. holding times for both cases and the tables below the figure contain the calculated values.

It is interesting to carry the concentration history plots one step further. The concentration functions in the longitudinal reactors can be reduced to straight-line plots by plotting concentrations against the quantity  $(1-\epsilon^{-\delta})$  or simply against the conversion, x.

The backmixing plots could also be reduced to straight lines by plotting concentrations against the quantity [b/(1+b)], or against the conversion, x.

In both the longitudinal and backmixing cases the yield of R is equal to

$$k_1/(k_1 + k_2)$$

or 73%; and the yield is independent of time, conversion or the degree of backmixing.

#### Other Parallel Reactions

Another common group of parallel reactions can be represented by these equations:

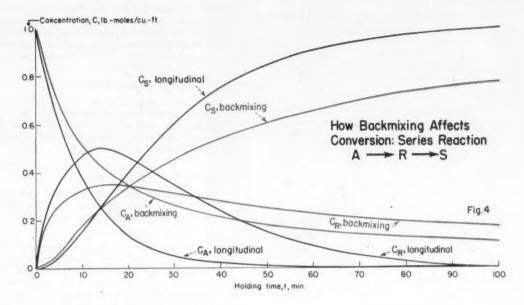
$$\begin{cases} A + B \xrightarrow{k_1} R \\ A + B \xrightarrow{k_2} S \end{cases}$$

The general principles that we described above for parallel reactions apply equally as well to this type of reaction. Although the added factor of mole ratio can be brought in, here again we can use the same principles that apply in the case of the simple reaction

$$A + B \rightarrow R$$

The reaction type that is indicated by the equations

$$\begin{cases} A + B \to R \\ A + C \to S \end{cases}$$



is another group of parallel reactions. However, this group of reactions is not very significant.

Here's why. If R is the desired product, the yield would be kept up at a high level by purifying the B and all of C. This is actually the case many times when pure reactants are required for a commercial process.

#### Series Reactions: Products React Further

In many reactions, the product, once formed, goes on to react further. This is a series reaction and in simplest form we can write the reaction equation as

$$\begin{array}{ccc} k_1 & k_2 \\ A \to R \to S \end{array}$$

We'll discuss this reaction in detail since it is the easiest in the class of series reactions and will present no mathematical development problems.

A typical plot of concentration vs. holding time for the reaction

$$A \rightarrow R \rightarrow S$$

is shown in Fig. 4. The important things to note about this figure are these:

The concentration of R passes through a maximum value.

 There is an inflection point in the curve for the concentration of S.

The rate equations for reactions of this type are as follows:

$$- dC_A/dt = k_1 C_A^n$$

$$dC_R/dt = k_1 C_A^n - k_2 C_R^m$$

$$dC_S/dt = k_1 C_R^m$$

Integral reaction rate equations have been worked out for the case of first order reactions. These are discussed in Daniels' and Frost and Pearson.' We discussed first-order reactions to some extent last month and worked out a sample problem.

The first-order rate equations are

$$- dC_A/dt = k_1 C_A$$
  

$$dC_R/dt = k_1 C_A - k_2 C_R$$
  

$$dC_S/dt = k_1 C_R$$

From the first equation,

$$- dC_A/C_A = k_1 t; \text{ and } C_A = C_{Ao} e^{-pt}$$
 (8)

where  $p = k_1$ . The second equation becomes

$$dC_R/dt = k_1 C_{Ao} e^{-pt} - k_1 C_R$$

This has been integrated to

$$C_R = [k_1 C_{Ao}/(k_1 - k_3)] [e^{-pt} - e^{-qt}]$$
 (9)

for the case where no R or S is recycled. In this equation p equals  $k_1$  and  $q = k_2$ . The concentration of S is determined by material balance.

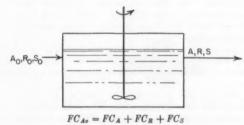
$$C_S = C_{A*} - C_A - C_R$$

If we define a new term, kappa, as  $\kappa = k_1/k_1$ , Eq. (9) becomes

$$C_R = [1/(\kappa - 1)] C_{Ao} (e^{-pt} - e^{-qt})$$
 (10)

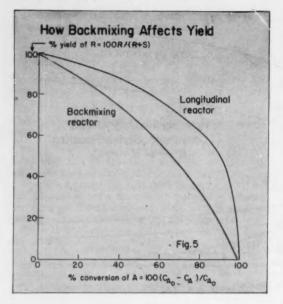
#### **Backmixing Equations for Series Reactions**

The equations for the case of backmixing are derived by material balance as before.



 $FC_{Ao} = FC_A + FC_B + FC_A$   $FC_{Ao} = FC_A + (k_1/C_A)$   $C_{Ao} - C_A = k_1 (V/F) C_A$   $C_{Ao} - C_A = k_1 tC_A$ 

 $C_{Ao} = C_A (k_1 t + 1)$  $C_A = C_{Ao}/(1 + k_1 t)$ 



where t is the holding time in the backmixing reactor.

A material balance on R gives:

$$\begin{split} FC_{Bo} + Vk_1 & C_A = FC_R + Vk_2 C_R \\ & C_{Bo} + (V/F) \ k_1 C_A = C_R + (V/F) \ k_2 C_R \\ & C_{Ro} + (V/F) \ k_1 C_A = C_R \ [1 + (V/F) \ k_2] \\ & C_R = C_{Ro} + (V/F) \ k_1 C_A / [1 + k_2 \ (V/F)] \\ \text{But } C_A = C_{Ao} / [1 + k_1 \ (V/F)] \end{split}$$

Therefore,

$$C_R = \frac{C_{Ro} \left[1 + k_1 \left(V/F\right)\right] + k_1 \left(V/F\right) C_{Ao}}{\left[1 + k_1 \left(V/F\right)\right] \left[1 + k_2 \left(V/F\right)\right]} \tag{11}$$

or in terms of holding time,

$$C_R = \frac{C_{Ro} (1 + k_1 t) + k_1 t C_{Ao}}{(1 + k_1 t) (1 + k_2 t)}$$
(12)

If there is no recycle,  $C_{B*} = 0$ . Then,

$$C_R = k_1 t C_{Ao}/(1 + k_1 t) (1 + k_2 t)$$

Once we know  $C_B$  and  $C_A$  for any value of holding time, we can determine  $C_B$  from a material balance.

$$C_{Ao}-C_A=C_R-C_{Ro}+C_S-C_{So}$$

In Fig. 4 we show a plot of the concentrations of A, R and S against holding time for both backmixing reactions and for longitudinal or batch reactions. The black lines are for batch reactions and are taken from Daniels. The colored lines are for the same reactions but are for the case of complete backmixing.

Each value of t for the backmixing reactions represents the concentrations at the discharge of a reactor that would have a holding time equivalent to t

We can see from Fig. 4 that at the point of maximum concentration of R in the effluent, the concentration of R is greater for the longitudinal reactor than for the backmixing reactor. In the illustration presented, for example, after a holding time of 15 min. the concentration of R in a longitudinal or batch reactor is 0.5 lb.-moles/liter.

The concentration in the effluent of a backmixing

reactor of the same holding time is 0.34 lb.-moles/liter. The fact that the maximum concentration of R occurs at the same holding time is coincidental. It is the result of the particular constants involved and is not a characteristic of this reaction.

#### How Backmixing Affects Yield

The yield of R is greater for a longitudinal or batch reactor for all values of conversion. Fig. 5 is a plot of the yield of R against the conversion of A. We can see from this plot that any amount of backmixing will decrease the yield of R.

#### **Equation for Product Distribution**

We have presented above Eqs. (8), (9) and (10) for longitudinal reactors and Eqs. (11) and (12) for backmixing reactors for the series reaction

$$A \rightarrow R \rightarrow S$$

This reaction involves only one reactant and two products. If the series reaction were to continue so that four or five products would be involved, the equations would become much more complicated.

In some cases we may be interested only in the distribution of products as conversion proceeds. Such equations, which involve only relative amounts of products, and in which holding time is not involved, have been worked out for series reactions. We plan to discuss this type of reaction soon.

#### **Coming Next Month**

Next month's installment of your CE Refresher will deal with the more complicated case of reactor design for complex-series reactions. In that discussion we'll attempt to present a logical development of the product distribution equation. More explicit examples of the use of this type of equation will also be presented.

#### REFERENCES

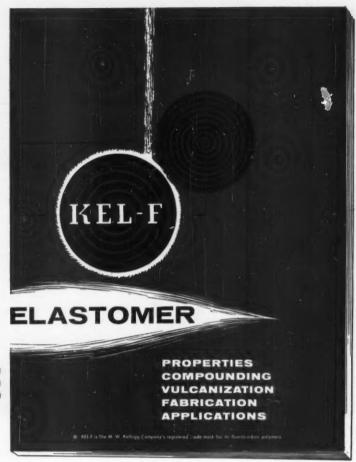
1. Daniels, Farrington, "Chemical Kinetics," Cornell University Press, Ithaca, N. Y., p. 27 (1938).
2. Frost, Arthur A. and Ralph G. Pearson, "Kinetics and Mechanism," John Wiley & Sons, Inc., New York, p. 153 (1953).

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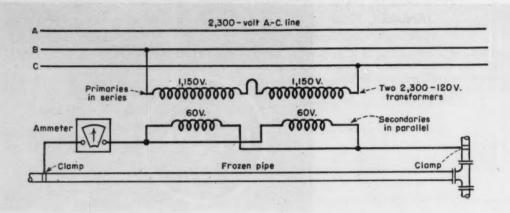


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**★** Winner of October Contest

### Use Electric Heat to Speed Thawing of Frozen Pipes

Now that cold weather has returned, it's time to plan for pipe thawing in case of possible freeze-ups.

Paul C. Ziemke

Safety and Maintenance Engineer, Oak Ridge, Tenn.

Electricity is readily available in every plant. Not only that—but it is not difficult to use for the quick thawing of frozen pipes if the need should arise. Your maintenance men can do it easily if they know how.

There are several ways to use electricity safely for pipe thawing. One, as we shall see later, is to use an arc welding machine to supply the necessary low-voltage, high-amperage current. However, if an arc welder is not available, a plant can generally

find a number of spare transformers and work out the desired step-down as follows:

The diagram above illustrates the idea. Suppose that the available supply near the point where thawing is needed is a 2,300-volt line. We have a number of 2,300 to 120-volt transformers and wish to reduce the voltage for hooking on to the frozen pipe. By connecting the primaries of two (or more) transformers in series, we can reduce the output voltage—to 60 v. with two trans-

formers, or 40 v. with three. Then by connecting the secondaries in parallel we can develop sufficient output capacity for the thawing job.

Ordinarily, in the cold weather which makes such a hook-up necessary, heat will be dissipated so rapidly from the transformers that no harm will result. However, to guard against possible overloading, it is good practice to install a fuse of the proper rating for transformer protection

If there is likely to be much pipe thawing during the winter, it is a good idea to mount the

Turn Page for Winner of \$100 Annual Contest

★ Winner of November Contest:-

### **Sump Pump Measures Steam Consumption**

By Steve Taborosi, Process Technician, Westvaco Mineral Products Div., Carteret, N. J.

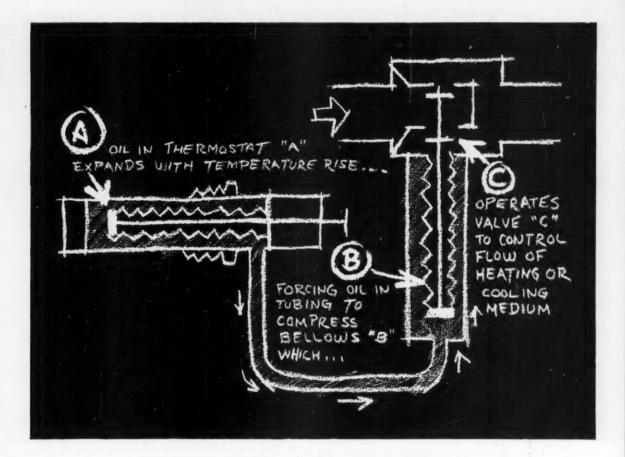
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#### \$100 Annual Prize Winner for 1955 \*

# Condensate Provides Pump Seal Liquid

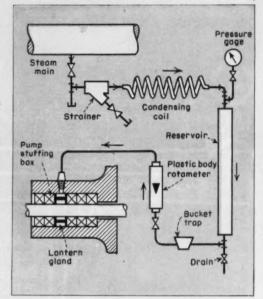
Edward J. Gibbons and James Ulrich Research & Development Dept., Colgate-Palmolive Co., Jersey City, N. J.

There are many installations of centrifugal pumps, positive displacement pumps, turbine pumps and others with rotating shafts that could be improved by water lubrication, force-fed to the lantern ring of the stuffing box. Due to the low feed rate of water (usually about 10 cc. per min.), and the high pressure needed, an auxiliary pump is indicated. However, its cost, space requirement and the extra problems it presents usually prevent its use.

We solved this problem by using condensed steam fed to the lantern ring under the influence of the steam pressure. This gave a clean, reliable and easily controlled source of water pressure high enough to overcome the pump pressure and perform its lubricating function properly.

Equipment needed consists of a radiation coil of \(\frac{1}{2}\)-in. diam., copper tubing, long enough to condense 1.5 lb. of steam per hr.; a 3-in. diam. steel pipe 30 in. long to act as a reservoir; a small steam trap to prevent steam from blowing out in the event of a bad leak; a small, inexpensive plastic rotameter; and some pipe and fittings.

Operation of this equipment is simple. The steam valve is turned on and condensation starts to fill the reservoir. After 5 min. the rotameter valve can be adjusted to give the required feed. Since the upstream pressure is always equal to



the steam pressure and is constant, little attention is needed after that.

This system is economical to install, it can be placed high up and remote from the pump, is dependable, provides sterile water if necessary and overcomes objections to using city water. A more elaborate system would be to replace the coil with a small heat exchanger which could be manifolded to serve several units.

\*This article, reprinted from the December 1955 issue, has been selected by the editors as the best monthly Plant Notebook winner of the year. The authors will therefore receive an additional prize of \$100.

transformers and allied equipment on a trailer so it can be towed to the scene of the trouble. This can be barricaded to keep out unauthorized persons. In use, the equipment must be properly grounded, and it should not be left unattended for too long a time, especially since a burst pipe may gush water once the stoppage has been relieved.

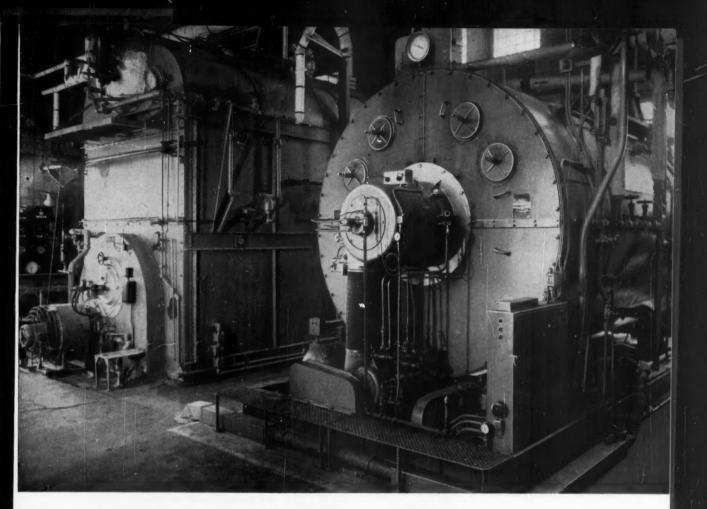
In making connections to pipes, make sure that clamps of sufficient size and capacity are used, and that the pipe is thoroughly cleaned of paint, rust, oil or chemical salts at the point of attachment. A faulty connection may overheat or cause arcing, leading to possible fire hazard. All electrical system grounds attached to the section of pipe undergoing thawing should be disconnected; failure

to do so may cause service interruptions when these grounding devices are called on to protect electrical circuits. Even telephone ground wires should be disconnected. And, of course, all such grounds must be reconnected after thawing.

When available, both d.c. motor-generator type welding machines, and the a.c. transformer type, are good for pipe thawing. In fact, welding equipment has an advantage over other electrical methods in being selfregulating and easily controlled. In use the same precautions are required as with the transformer method described. It is a good idea to use a portable voltmeter to check the voltage drops prevailing, and to check the continuity of the circuit. How much length of pipe of a given size

can be handled at one time can be determined by cut-and-try. In starting the operation the machine should first be set at the lowest current output adjustment, to permit checking connections with the least possibility of flashing. Welders can be operated continuously at less than 80% of their ampere rating; or intermittently for periods up to 15 min. at higher outputs, provided enough time is allowed for return to normal operating temperature.

Care is needed in thawing lead pipe, or pipe with leaded joints, since lead will handle less current than iron. In fact, any case of a high-resistance joint may cause overheating and a possible fire hazard, so it is desirable to check joint resistance before thawing is commenced.



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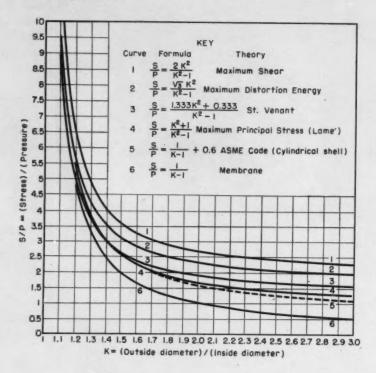


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### **Chart Compares Vessel Design Theories**

R. W. Schneider

Engineering and Loss Control Division, The Travelers Insurance Co., Hartford, Conn.

Pressure vessel designers are often faced with the problem of selecting a formula for computing the wall thickness of a cylindrical vessel under internal pressure. When the design pressure is relatively low, then the various theories, and the resulting formulas, give comparable results. However, as the pressure increases these same formulas may give widely varying results.

When this is the case it becomes the designer's problem to select a formula which will not only give a safe vessel, but also an economical one, so far as good judgment will permit.

To compare the results given by the various theories, their formulas must be compared on a consistent basis. This has been accomplished graphically in the chart above by plotting the ratio of stress S to pressure P (as ordinate) against K, the ratio of outside to inside diameter.

The chart illustrates the following theories: (1) Maximum Shear; (2) Maximum Distortion Energy; (3) St. Venant; (4) Maximum Principal Stress (Lamé); (5) ASME Code; and (6) Membrane. The applicable formulas are listed on the face of the chart.

The ASME Code formula is usually accepted when the design pressure is low.

For the medium pressure range the Lamé (Maximum Principal Stress) formula is generally employed.

The Maximum Distortion Energy theory is widely used in the high pressure range, which represents those vessels with a large K value.

No attempt is made to place an exact numerical value on the three pressure ranges, since considerable overlapping may be found by engineers who use the formulas.

The chart may be used to compute the vessel wall thickness, in which case S is taken as the maximum allowable working stress at the design temperature, and P as the design pressure. Instead, the chart may be used to estimate the pressure at which initial yielding will take place, in which case S becomes the yield point of the material in simple tension, while P is the pressure at which yielding will commence at the inner wall.

Note that the chart applies to seamless shells, but it can be used for other shells by multiplying the expression S/P with a suitable joint efficiency E, as required for the type of vessel under consideration.

It is generally agreed in considering the pressure at which the start of elastic failure occurs that the Maximum Distortion Energy theory accords more closely with actual tests than the other theories, especially in pressure vessels which fall into the "thick-wall" category.

The fact that a vessel satisfactorily passes the usual hydrostatic tests, or performs without mishap in service, does not mean necessarily that the correct design formula was used. Instead, it may mean that the actual safety factor, based on the start of elastic failure, is not what the designer originally intended it to be.

#### Hole in Boiler Union Saves Heating Element

Carl L. Murray

Associate Engineer, Phillips Petroleum Co., Idaho Falls, Idaho.

At a plant where I once worked we had trouble with burned-out electric heating elements in a potable hot water heater. This resulted from interruptions in the potable water supply which was provided by a pump in the basement, one floor below. Whenever the pump was cut off, all of the hot water siphoned back into the basement, leaving the tank high and dry.

We could have corrected this trouble by re-piping the hot



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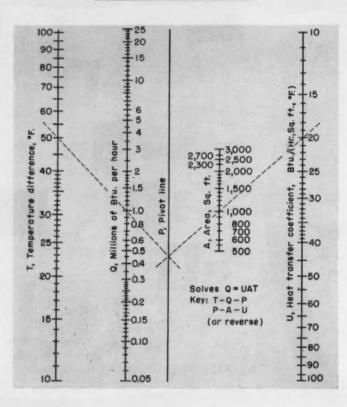


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water heater to the roof supply tank, but this would not have afforded satisfactory pressure at the hot water taps.

Instead, we used a very simple expedient to correct the trouble once and for all at a minimum of cost. Since the drop pipe in the hot water heater was acting as the short leg of a siphon, it was

necessary only to provide a vacuum break above the water level. This was done by removing the boiler union which brought the cold water line into the top of the tank, and drilling a ½-in. hole on its underside. This created the needed siphon break and prevented hot water from siphoning back to the pump.

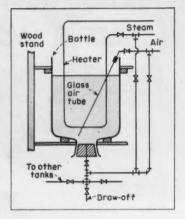


#### **Quick Answer to Heat Transfer Equation**

Tom Flynn Chemical Engineer, Bellaire, Texas.

Presented above is a nomograph which greatly facilitates the solution of the heat transfer equation Q = UAT, where Q is the quantity of heat transferred, in Btu./hr., U is the overall heat transfer coefficient in Btu./(hr., sq. ft., °F.), A is area in sq. ft., and T is the temperature difference in °F. Its use is convenient with one of the available nomographs  $\Delta T$  to generature difference.

Example—Let the temperature difference T be 50 F., the heat transfer coefficient U be 20, and the area A be 1,000 sq. ft. How much heat will be transferred? Connect the scales in the order U-A-P and T-Q-P, showing that Q=1 million Btu./hr. Any one term of the equation can, of course, be found from the other three. The only restriction is that the scales can not be connected across the pivot line.



#### Lab Unit Duplicates Batch Tank Operation

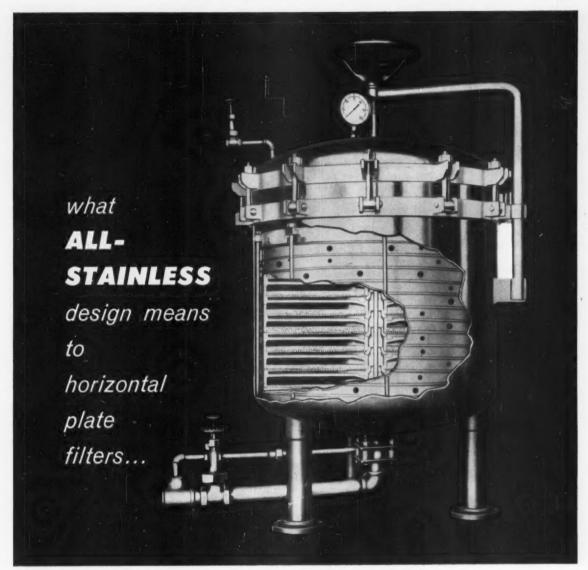
Paul N. Cheremisinoff Chemical Engineer, Dumont, N. J.

A common problem in developing a new process is to be able to run experimental work or to duplicate plant runs on a scale less than that of the pilot plant, yet larger than beaker scale. A small unit capable of simulating open batch tank operation can easily be set up in the following manner.

A narrow-mouth glass bottle or jar, ranging from 5-gal. to carboy size, can be used as the vessel itself, with the bottom cut out. The inverted jar is easily supported with a simple wooden stand. If desired, several such "tanks" can be set up in series, or other arrangement.

The accompanying diagram shows how such a vessel can be piped up, using 4-in. pipe and valves. A mechanical agitator can be used if desired, but in lieu of that, agitation can be provided by an open air line to the bottom of the vessel, connected to a small mechanical blower or a cylinder of inert gas.

A U-coil is provided as shown for heating, connected to a steam supply. Then, to enable the product line and valves to be blown out with air or steam (or to permit heating the vessel contents with live steam if desired) connections can be provided from the steam and air supply lines to the bottom connection of the vessel, as the drawing indicates.



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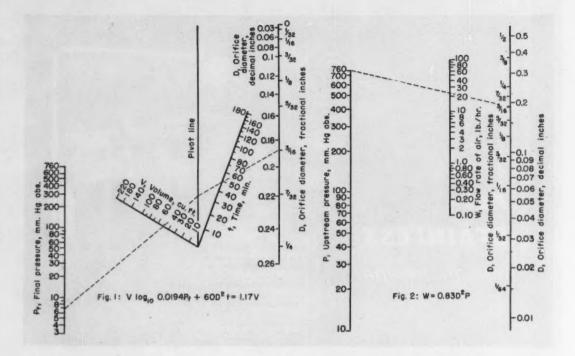
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#### **Charts Solve Vacuum System Problems**

Robert E. Greenhalgh and J. William Miller Respectively, Project Engineer and Chemical Engineer, Dow Corning Corp., Midland, Mich.

A continuous vacuum system which serves more than one process unit often consists of a single vacuum pump or ejector. This is sized so as to be able to evacuate an individual unit, while at the same time it maintains the vacuum, without disturbing the equilibrium, in the rest of the system. Normally, an orifice is provided to limit the flow during pump-down.

The two nomographs above furnish a rapid means for sizing the vacuum pump and the orifice, and for finding the time needed to evacuate a system of any volume from atmospheric pressure down to the desired final vacuum. Fig. 1 represents an integration of the orifice (rate) equation in terms of volume, orifice diameter, elapsed time, and final pressure. Fig. 2 is a special case of the same equation relating orifice diameter, upstream pressure, and flow rate.

Both nomographs are based on air at 60 F. flowing through an orifice whose diameter is less than one-fifth the pipe diameter. The equations are valid whenever the pressure in the vessel being evacuated (upstream pressure) is more than 1.89 times the pressure at the vacuum source (downstream pressure).

Problem—In a system of three users, two (having a total maximum air leakage of 2 lb./hr.) are already operating continuously at 3 mm. Hg abs. It is desired to evacuate a third user of 50 cu. ft. capacity down to the same absolute pressure in 50 min.

#### Nomenclature

- D Orifice diameter, inches.
- P Upstream pressure, mm. Hg abs.
- $P_f$  Final pressure, mm. Hg abs.
- t Time, sec., to pump volume V from 1 atm. to final pressure  $P_f$ .
- V Volume to be evacuated, cu. ft.
- W Flow rate of air, lb./hr.

What size orifice and what size vacuum source will be required?

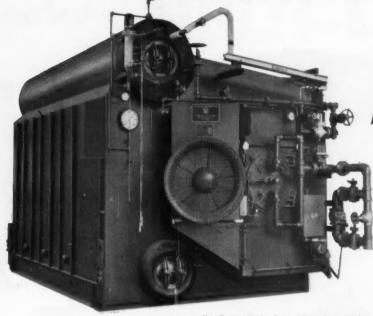
The pressure downstream of the orifice will be 3 mm. Hg abs. The lowest user pressure for which the charts can be applied is  $1.89 \times 3 = 5.67$  mm. Hg abs. When that pressure is reached there will be negligible air remaining in the user, so that the orifice can be bypassed and the user immediately evacuated to 3 mm.

On Fig. 1 connect 5.67 on the  $P_t$  scale to 50 cu. ft. on the V scale, marking the intersection on the pivot line. Connect this point with 50 min. on the t scale and read the desired orifice diameter as  $\frac{1}{4}$  in. on the D scale. The maximum flow through the orifice will be at the beginning of the evacuation, i.e., when the user is at atmospheric pressure. Therefore, on Fig. 2, connect 760 mm. on the P scale with  $\frac{1}{4}$  in. on the D scale and read the flow rate as 22.2 lb./hr. on the W scale.

Consequently, to handle all three users under the conditions noted, the vacuum source must have a capacity of 22.2 + 2 + 2 = 26.2 lb./hr. of air at a pressure of 3 mm. Hg abs.

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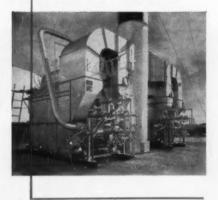
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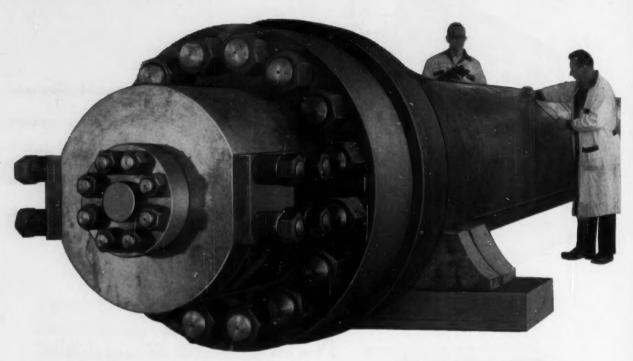
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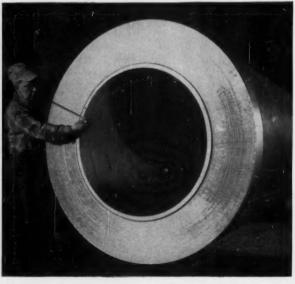


## MULTI-LAYER AMMONIA CONVERTER Built for operating pressures of 12,500 psi. . . . test pressures of 18,750 psi.

Wall thickness 9<sup>13</sup>/<sub>16</sub> in. . . . I. D. 25<sup>3</sup>/<sub>16</sub> in. Overall length is 44 ft. Weight 238,000 lbs.



**SAFETY** — Nearly 8000 MULTI-LAYER vessels in operation — and not a single failure — certainly convincing proof of the safety inherent in this unique A. O. Smith design. To further prove operating safety, we have actually tested many full-scale, high-pressure MULTI-LAYER vessels to destruction. In every case, vessels rupture without shattering or fragmentation.



January 1956—CHEMICAL ENGINEERING

# ...8000 reasons why you can depend on exclusive MULTI-LAYER

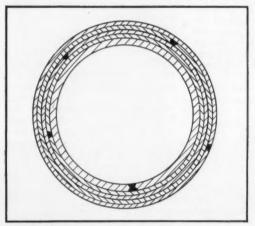
CONSTRUCTION



FOR SAFETY

FOR ECONOMY

FOR FLEXIBILITY



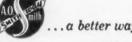
**ECONOMY** — Savings start with fabrication. Instead of using thick plate in a single wall, MULTI-LAYER vessels are built up from concentric layers of relatively thin steel plate . . . progressively wrapped, tightened and welded together around an inner, pressure-tight cylinder. No need for costly stress-relieving in field assemblies. And for corrosive operations, only the inner shell requires special alloys.

FLEXIBILITY—With MULTI-LAYER, there's no limitation of size or weight for your vessel design. You can design for higher pressures, too. Walls can be made stronger simply by increasing the strength

of the steel used or by adding more layers. Since shell sections can be welded together in the field, vessel

See how A. O. Smith's exclusive MULTI-LAYER construction can provide safety, economy and flexibility in your own operations. Write our nearest office. We'd be happy to provide more detailed information about MULTI-LAYER construction for high-pressure vessels.

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EDITED BY H. T. SHARP

## Look for Jobs to Abound in Coming Months

With few exceptions, chemical engineers on the prowl for a new job this year will have little trouble landing one. Salaries seem to be edging up too.

I F CURRENT indicators prove accurate, 1956 should be one of the best of all years for job-seeking or job-changing chemical engineers.

In following through on announced expansion plans, the chemical process industries will easily absorb the 1,200 or so new men left them after ROTC programs, the draft and the graduate schools take their slice of the 2,500 Ch. E.'s\* which will graduate in 1956.

This year's service returnees, guesstimated at about 1,500, will be rapidly integrated too.

And there'll be plenty of openings remaining. Engineering employment agencies, for example, are extremely optimistic, pointing to a substantial backlog of company requests as evidence. Most, however, caution potential job-hoppers that just because a company says it needs a man doesn't mean it won't be choosy in hiring.

Quality is turning into something of a watchword with employment directors. As one phrased it to us: "We have several openings for chemical engineers right now and at the rate we're going we expect to have several more to fill in the next few months.

"Though we don't get as many applicants as we would like, we are selective and we intend to stay that way. Most of the applicants we reject are turned down on personality grounds. We feel they just wouldn't mesh with the people we have already. Others fail to meet the job's requirements. No matter how severe our need to fill a particular opening, we try to hold out for just the right man. It only compounds our problem to hire people whom we feel can't contribute properly.

We always have to let them go later anyway."

As usual, engineers over 50 will face the biggest problems in their job hunts. Their great experience won't mean much unless a big chunk of it is in management posts, or unless they've established a notable reputation in their specialty.

Most job-seeking over-50's will find that the jobs they are offered carry salaries much below those they've been accustomed to. But a few employment agencies say that recently, at least, they've gotten "a couple of requests each week" for men over 50. This is a distinct change from a year ago. None will predict how far into 1956 this trend will carry.

This, then, is the over-all picture. To move to its more specific aspects, here's the job outlook for chemical engineers in various job categories.

#### In Research

Engineers are scarce, many companies say. But most look to new graduates to fill needs, limit hiring of older men to specialists who can plug a specific opening.

You'll have no trouble finding a job in chemical engineering research—provided you're a relatively recent graduate with a pretty high academic rating, a young fellow with a graduate degree or two, or an older engineer with a solid record of research accomplishment.

Certain specialists, particularly in ceramic, polymer and radiation research, are also in demand.

You'll hear more about quality here than you will in any other area of engineering. Sheer numbers of researchers don't mean too much. A recent National Science Foundation-backed survey of some 33 chemical and allied products firms, including all major companies, found that only 20% claim that a lack of manpower impedes or retards current research and development programs. And half of the companies didn't report shortages at all. But nearly all made a point of the strong competition for the best-qualified personnel.

Since some companies say that this year they'll spend well over \$2,000 on recruiting expenses for every man hired, their stress on quality is natural.

In hiring, most of the emphasis falls on youth — with freshfrom-the-campus Ph.D.'s marked as prime targets.

This feature of the manpower squeeze puts a similar squeeze on salaries. The going rate for researchers with a few years experience isn't climbing nearly as fast as the rate for new grads.

A B.S. straight from school will probably command close to \$400 per month this June. One with his military experience behind him—but with no job experience—will start at about \$20 per month more (though some employers make a strong effort to start them at much less by stressing their lack of experience and the time spent away from their studies). Men with up to three years experience make very little more—and in some cases even less.

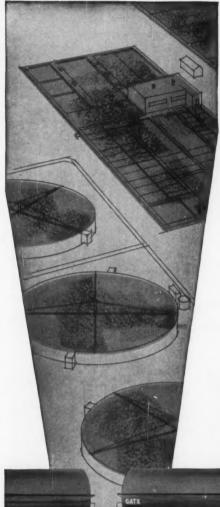
Salaries appear to be improving, however, for men with over five years experience and for group and project leaders.

#### In Development

The accent's on youth here, too. But engineers with five to ten years experience stand a good chance of locating a spot.

Especially in the South and Midwest, chemical engineers for process development work are ex-

<sup>\*</sup>U. S. Office of Education estimate.



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pected to be in relatively short supply.

Quite a few chemical companies assign virtually all Ch.E. recruits with little or no experience to their development groups. Therefore, the lack of sufficient fledglings to go around means that they'll have a tough time keeping their staffs fully manned. This is opening opportunities in development to men with several years experience in other types of chemical engineering work. And it has also led to some mild pirating.

A few of the larger East Coast firms complain that they spend about \$2,500 to recruit a man plus another \$13,000-17,000 in salary alone in the first three years he's with them—only to see him leave for a smaller company willing to pay \$30-50 per month more. They say that holding on to the men they've spent a couple of years and a thick wad of money training is a much tougher job than recruiting.

Nub of their complaint is that the firm that hasn't already spent this money on the man is in a better position to pay a higher rate than they are.

Smaller companies say they have no choice. They feel that the bigger firms can do a better job of recruiting at the college level, so it's "realistic" to wait until the man has some experience and training before hiring him. They're fairly unanimous in pointing out that when the bigger company wants a man badly enough, it'll meet any offer.

This has meant a steady rise in salaries, but—"pirating" or not—it hasn't been noticeably rapid in the past year or two—except, of course, for newly graduated men.

Men over thirty contemplating a switch to development work, or a change to another company, should look twice and have something definite in hand before making a jump. Both big companies and small appear reluctant to take on such men unless they have a needed skill or specialty, or unless they have a background which fits them for a supervisory job.

Finding top notch project leaders and group leaders is a tough job, virtually all companies claim.

#### In Process Design

Need for experienced men grows. On the West Coast, in particular, pirating is again in vogue.

Among the highest riders on the crest of industry expansion, chemical engineers in process design work are in demand right now and, allowing for the usual ups and downs of employment in this work, will continue to be needed through '56.'

Reports of pirating among engineering firms, and between these firms and their clients, are again being heard. On the West Coast, especially, the practice appears to be widespread. Says one observer, "There's always a little of this going on, but now it's just about the only way to get a first rate man with the right experience.

In the East, process design men appear to be slightly more plentiful. One company claims that an ad in the Sunday papers will bring "more than enough" people to its doors on Monday. Other firms are quick to say it doesn't work that way for them. Some relatively inexperienced men may appear, few with needed experience.

To fill openings for design men some companies use transplanted, foreign-trained engineers.

Again, however, you'll hear the cry for "the right experience." Process design work, apparently, is becoming something of a Mecca for many chemical engineers. Employment director for one of the biggest engineering firms tells us that he gets many applicants but those with the proper background are rare. To him the "proper background" includes a B.Ch.E., a few years on the design boards and in making design calculations on a variety of jobs, probably an M.S. picked up in night school and "a decent personality."

The median salary of chemical engineers in process design appears to be rising, but not particularily fast. One prominent company says that it's only "holding its own." Prospects for 1956 look brighter, though. Demand should remain relatively high while the supply of men with experience will be a bit shorter, if anything.

#### In Production

Salaries appear relatively static, and hiring problems are starting to spread. Unions are keeping an eye on the situation.

It used to be pretty easy to find chemical engineers for plant work. It isn't anymore.

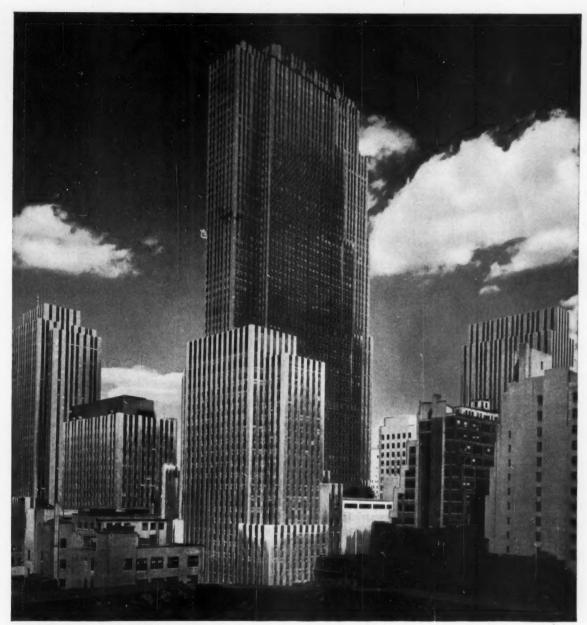
The advancement opportunities in production supervision are not the lure they once were when stacked against the disadvantages of shift work, spartan working conditions and a comparatively low salary scale—especially for younger men. Salaries for new graduates recruited for work in production will likely run \$20-40 per month below those offered men tapped for research, development or for sales engineering.

To ease the pinch, companies shift men with development experience to plant engineering posts, train operators to take on the lower level supervisory jobs and use men with degrees in chemistry for production supervision.

A young engineer won't have too much trouble finding openings in this type of work. There are also openings for older engineers. But, except at relatively high levels—area supervisor, assistant plant manager and up—salaries aren't particularly attractive when compared with those for other types of work. This, incidentally, is causing

#### Next Month: How to Pass the Licensing Exam

We'll look at professional registration from a different angle next month—the angle of the fellow about to take the test. John D. Constance will draw on his 13 yr. experience in aiding engineers prepare for and pass state exams and offer a hatful of helpful tips. He'll cover both what and how to study, what helps to use and how to tackle the test itself.



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RESEARCH AND EXPERIENCE DEVELOPED THE FINE CHARACTER OF ESSO SOLVENTS

both worker unions and engineer unions to eye the situation. Till now engineer unions have concentrated on large groups of men working for a single firm at one location. Now, however, there's talk of forming intercompany bargaining units for areas heavy with chemical plants. In addition, worker unions—AFL groups in particular—are planing and running organizing drives.

As now planned, technical men would be grouped in separate units, distinct from present worker groups. Bargaining objectives would be overtime pay and differentials for hours on shift work.

#### In Marketing

Difficulties and complexities of marketing problems will continue to build opportunities for engineers. Salaries are being forced up by lack of skilled men.

More and more chemical companies are discovering that their toughest job isn't creating new products, but creating new customers. And these firms are attacking this problem with essentially the same methods they use to create the product and bring it into production.

In the past two years there's been a noticeable increase in the number of companies assigning chemists and chemical engineers to gather and evaluate marketing data. Now practically every chemical company of stature has a group of such men to back up its sales force.

In all phases of chemical marketing—market research, product development, sales and technical service—there appears to be a demand for chemical engineers with a marked aptitude for the business side of the industry.

Salaries of chemical engineers in marketing probably run somewhat higher than those earned by men in straight engineering work. For instance, companies report that it is difficult to land a good market researcher with over 5 yr. experience in the field for less than \$9,000. These companies consider \$7,000-8,000 a more "reasonable" price for such a man.

#### In Management

Demand is relatively high, but so are the requirements and getting a job isn't an easy task.

Expansion - created openings are draining the pool of available executive talent. That's what chemical firms say when asked about their need for management-ready engineers. Many point to the wildfire-like spread of executive development programs throughout the industry as one symptom of this need.

But—as a good many mergerdisplaced engineer-executives learned in '55—these programs have also tended to turn management opportunities into a family affair. Most companies, they say, are now so wedded to promotefrom-within policies that the "outsiders" qualifications aren't given proper weight.

Naturally, this tendency will give the engineer hunting a management post this year a difficult time. But, though you'll probably have to spend more time searching than you care to, the jobs are around.

Management consultants, who often serve as point of contact between chemical companies and job-hunting executives, report a "terrific" number of company requests for men with engineering backgrounds now, as compared to prior years. However, requests invariably call for men with a specific type of background and, generally, with a number of years of management experience. The neophyte stands relatively little chance.

Firms specializing in executive recruiting—and their ranks have swelled greatly in the past few years—report the same thing.

In any event, if you're hunting for a management post, it's best if you're under 45. Past that age the odds on finding a spot grow considerably longer. Of course, you'll be in better shape if you can point to a background of successful management experience.

For those who do land a spot, salaries will be high as in '55 and the median appears to be rising. Stock options and other profit sharing schemes are spreading. And recent studies show that chemical executives are being paid pretty well compared to their counterparts in other industries.

## WAGE DIVIDEND

#### ... Due Kodak Employees

Next March the 51,000 men and women employees of Eastman Kodak will each get a slice of a wage dividend estimated at about \$32,175,000.

Eligible persons will receive \$30.25 for each \$1,000 earned at Kodak from 1951 through 1955. Hence the chemical engineer who's been averaging \$8,000/yr. for the past five years will be able to cash a dividend check for \$1,210.

This is Kodak's way of rewarding both stockholders and employees for their contributions to a good corporate year. The amount of the employee dividend is based directly on the cash dividends paid holders of common stock.

When these stockholders get a cash dividend of over 70¢ per share nearly all U. S.-based employees become eligible for a wage dividend. This runs ½ of one percent for each 20¢ above the 70¢—and up to \$1.80. When the stockholder dividend reaches \$1.80, the rate of the wage dividend falls to \$10\$ of one percent for each 20¢ above the \$1.80.

The wage dividend, like stock dividends must be voted by the board of directors. It is paid in addition to regular wages and has no effect on wage rates.

The March payment will be the highest in the 43-year history of the plan. Designed, engineered and built by Struthers Wells...

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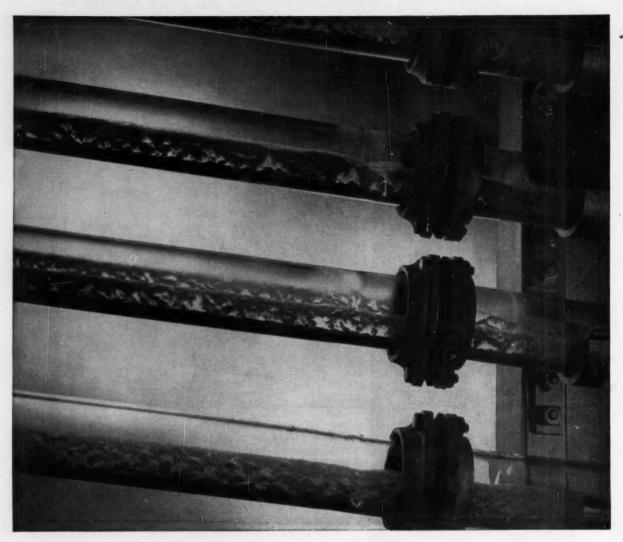


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Space doesn't permit us to describe in detail all the advantages of using Pyrex pipe—its clear transparency (you're almost certain to find this a great convenience); how you can plumb it in your own plant to meet any layout requirements; its relatively light weight; comparative costs. So let us send you any or all of the bulletins listed in the coupon on the opposite page.

You need only fill out the coupon and mail it to us for prompt action. Or, if you prefer to discuss your own specific problem immediately with one of our representatives, write, wire, or phone us, or our nearest distributor.

## corrosion resistance of Pyrex® pipe

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LOOK what one plant manager says. "There was no breakage during installation. There have been no lines broken because of the product handled, the temperatures involved, or the age of the pipe. There has been no accidental breakage. In short-there has been no breakage."

Every "product" line in this plant has been Pyrex pipe since 1943. The company switched to PYREX pipe because metal lines were quickly corroded by the acids in the products handled. Corrosion in the metal piping also made cleaning difficult, and the frequent replacements made maintenance very costly.

Thousands of engineers and operating men in hundreds of plants across the country have had the same experience with millions of feet of Pyrex brand glass piping. If you are not enjoying the troublefree corrosion resistance of PYREX pipe, because you are worried about breakage, why not talk to some of the people who are using it daily. We will be delighted to furnish you with the names of companies near you.

#### You can install it easily

More than 75% of the PYREX pipe now in use has been installed by our customers' own pipefitters. Proper installation is a relatively simple matter; you can plumb it in your

own plant to meet any layout requirements. It is easier to hang than many other kinds of corrosion resistant pipe, as there are no special hard-to-catch-on-to tricks about it. Our installation manual covering every detail is yours for the asking. And remember, once your PYREX pipe is in place, you can count on it for a lifetime of service.

#### Why PYREX pipe today is more durable than ever

The greatest strain on any type of pipeline is usually set up at the joints due to misalignment or lack of flexibility. To offset any such strain, all Pyrex pipe ends and fittings (except U-bends) are now tempered, which makes them up to four times stronger than previous fittings. In fact, we know of instances where the metal bolts have been accidentally tightened to their breaking point without the glass yielding. Alignment of lines is also easier now because of improved gasketing materials, inserts and a complete line of spacers and adjustable joints.

#### Maintenance problems can be reduced

The liquid smooth surface of Pyrex pipe does not pit. Deposits do not build up, so your product lines keep up to planned volume. Cleaning is simple, when necessary, as you can

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Pipe Size	Maximum Recommended Working Pressure	Maximum Sudden Temperature Differential	Maximum Operating Temperature
1"	50 p.s.i.	200° F.	450° F.
11/2"	50 p.s.i.	200° F.	450° F.
2"	50 p.s.i.	200° F.	450° F.
3"	50 p.s.i.	200° F.	450° F.
4"	35 p.s.i.	175° F.	450° F.
6"	20 p.s.i.	160° F.	450° F.

see the interior of the pipe at all times. Most users find their pipeline maintenance problems are reduced to a periodic inspection of joints and occasional tightening of flange bolts. One plant superintendent said, "Since Pyrex pipe was installed for all of our product lines, maintenance has been practically nil."

#### What does it cost?

Initial cost of Pyrex pipe compares favorably with most other corrosion resistant piping . . . and it is less expensive than some. Subtracting low installation cost, economical maintenance and long-time service from initial cost puts Pyrex pipe on the profit side of your plant budget instead of the cost-of-operating side.

I.D., Inch	O.D., inch	Mean Wall Thick., Inch	Stock Lengths (Feet)	Approx. Weights Lbs./Ft.
1"	15/16	5/20	1/2 to 10	0.6
11/2"	127/32	11/64	1/2 to 10	1.0
2"	211/32	11/64	1/2 to 10	1.3
3"	313/32	13/64	1/2 to 10	2.0
4"	41/2	1764	1/2 to 10	3.4
6"	6%	21/64	1/2 to 10	6.3



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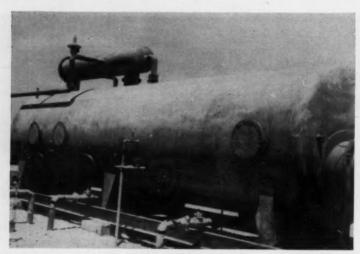
- 11 Crystal St., Corning, N. Y. Please send me the bulletins checked below:
- ☐ EA-1: "PYREX Pipe in the Process Industries" (Illustrated case histories)
- EA-3: "PYREX brand 'Double-Tough' Glass Pipe and Fittings Catalog"
- PE-3: "Installation Manual for PYREX Pipe" Please have your representative call on me.

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## **Improved Zinc Coating**

Compared with all-zinc coatings, zinc-filled silicate coatings have important advantages: cold application to existing structures and better corrosion resistance.

Rather than zinc alone as in conventional zinc coatings, this coating consists of an inorganic silicate that is highly filled with metallic zinc. The metallic zinc affords cathodic protection as with all-zinc coatings, and the combination of ingredients affords greater resistance to corrosion. Structures may be coated in place, which is not possible with hot dip galvanizing. Existing structures need not be dismantled, and new structures can

Note: Zinc-filled silicate coating was developed about 15 years ago in Australia where it has performed unusually well for very nearly that period. It has been used in this country for about five years. Our thanks go to the Amercoat Corp., South Gate, Calif., who are the U.S. patent licensees, for the most recent information about this unusual coating.—EDITOR.

be coated either before or after erection.

A chemical-physical bond is formed between the coating and a sand-blasted steel surface. The bond is such that it is virtually impossible to detect the interface, according to the manufacturer.

By means of a reaction that is not fully understood, a complex iron-zinc-lead silicate is formed during the curing of the applied mix. The liquid portion of the mix contains a water solution of sodium silicate, while zinc dust together with a small amount of lead make up the solid portion.

Curing of the applied coating is ordinarily done by chemical means. A curing solution containing phosphate, dissolved in a volatile organic solvent produces the insoluble silicate coating. Soluble material (phosphates or carbonates) formed during

the curing process may be removed by washing with fresh water.

This method of curing is usually more convenient, economical, and practical than baking. However, heat can be used to produce the same results where the equipment to be coated is small enough to be put into an oven and where sufficient similar units are to be coated to justify this type of cure

#### **Physical Properties**

Film thickness is approximately 2½ mils. This is attained in a one-coat application over sand-blasted steel, considered sufficient for most uses to which the coating would be put.

Whereas the coating will follow the normal expansion and contraction of rigid steel surfaces, it should not be applied to metal which is to be drawn, twisted or bent sharply. The coating is inferior to galvanized coatings in this respect.

Being a zinc silicate coating, it has good abrasion resistance. Cathodic protection afforded by the metallic zinc tends to inhibit corrosion in small abraded areas.

The chemical-physical bond provides excellent adhesion. A conservative temperature limit is 140 F. when immersed or continually exposed to water. When not immersed, the coating withstands continuous exposure at temperatures up to 500 F.

#### **Chemical Properties**

Because of its metallic zinc content, the coating is not suitable for immersion in acids or alkalis.

The combination with an inorganic silicate, however, provides a coating highly resistant to most industrial atmospheres.

Prolonged exposure to severe weathering conditions has had no visible effect.

Salt water resistance is excellent. It differs from coatings of plain zinc in this respect. In fact, salt water aids in curing the coating.

The coating is completely insoluble in petroleum hydrocar-



## **HASTELLOY Alloy B Handles** Hydrogen Chloride at 1000 deg. F

#### PROBLEM:

Handling highly-reactive hydrogen chloride gas containing water at 1000 deg. F at the top of chlorine burner towers used in making hydrochloric acid. Chlorine is burned inside the towers in a hydrogen atmosphere. Ordinary materials used at the top of these burners would last only a few weeks at best.

#### REMEDY:

Burner covers are made of HASTELLOY alloy B. The hot gas is channelled through a cast cross, piping, and valves made of alloy B.

#### RESULT:

30 to 40 times longer service is given by the parts of HASTELLOY alloy B. Down time is cut to a minimum and production is increased.

HASTELLOY alloy B is resistant to hydrogen chloride gas at high temperatures, wet or dry. It is also highly resistant to hydrochloric acid in all concentrations and at temperatures up to the boiling point. The alloy is readily fabricated and has strength properties comparable to high-alloy steel. For a copy of a booklet describing HASTELLOY alloys, get in touch with the nearest Haynes Stellite Company office.



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APPLICATIONS of zinc-filled coatings include structural steel and . .



APPLICATIONS for resistance to salt atmospheres and hydrogen sulfide.

bons. It is insoluble in aromatic solvents such as toluol, xylol, and benzol—and in ketones, esters, and alcohols. As long as no moisture is present, it is unaffected by chorinated hydrocarbons.

The coating is resistant to both vegetable and animal oils.

#### Applications

Chemical industry applications to which this improved zinc coating lends itself include the following: cooling towers, tank exteriors, exterior piping, structural steel, stacks.

Petroleum industry applications include aboveground pipelines, tank exteriors and interiors, floating roof tanks (exterior of roofs, interior of sidewalls), offshore structures and caissons, drilling rigs, salt water piping, "Christmas trees," refinery open work, steel structures, pipe racks, cooling towers. The coating is also used as a primer for vinyl top coatings.

#### Costs

Approximate material costs are 4.2-5 c. per sq. ft. for the coating, 1.2-1.5 c. for the curing solution.

Both the coating and the curing solution may be applied by either spray or brush. Since usually only one coat is needed, application costs are at a minimum.

#### **Now: Fluidized Coating**

Announcement of a revolutionary new process for providing corrosion-resistant coatings of polyethylenes, polyfluorocarbons, nylon and other plastics on metalic and dissimilar plastic molded targets, was recently announced by the American Agile Corp., Maple Heights (Cleveland), Ohio.

Until this time, certain targets could be coated with polyethylene to provide corrosion-resistant surfaces, by using special spraying equipment. However, many additional targets could not be sprayed because of their small size and/or irregular shapes.

The new process, known as the fluidized-coating process, was displayed for the first time at the 25th National Chemical Show, Dec. 5 to 9, in Philadelphia.

According to Dr. J. A. Neumann, Agile president and director of research, "the fluidized-coating process, a brand new concept in coating techniques, fills the last major gap in the anti-corrosion coating field. It will enable industry to apply onthe-spot corrosion protection when and where it is needed, at an exceptionally low cost, and in 50% less time than was required with spraying."

The process involves the use of a Powder Fluidizer, a compact unit consisting of a specially designed gas distribution system which maintains the plastic powder in a turbulent dense fluid state. Appearance of the fluidized bed closely resembles that of a boiling liquid.

Also available is a line of specially blended polyethylene coating powders, developed by American Agile, which can also be used with a spraying unit where this process may be used.

The fluidized-coating process provides a uniform coating up to  $f_0$  in. thick. The target to be coated is first preheated to predetermined temperature, then immersed in the fluidized coating powder for 10-15 sec. It is then replaced in the oven, and allowed to cure for a short period.

The process, at this particular time, will be available for use only in laboratories for coating such items as stirrers, valves, containers, racks, and handling tools—which can be given a firmly-adherent corrosion-proof cladding in a few minutes.

Within the next few months however, as larger coating units are built, applications to industry in general will be possible.

Dr. Neumann added that "expected additional applications for the new process include the coat-

For "economy, long life, and freedom from contamination,"

## DURCO is the choice at

#### NATIONAL ANILINE DIVISION

ALLIED CHEMICAL & DYE CORPORATION

Buffalo, New York

## Durcopumps and Durco valves were selected for:

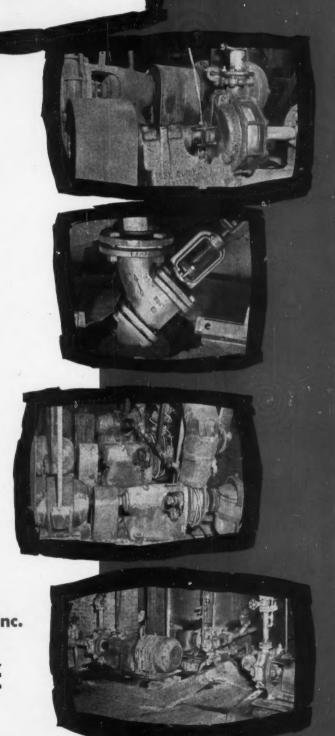
- ...transferring slurries of acid and direct dyes...
- ... sulfonation of organic compounds with 25% Oleum...
- ... concentrated solution of mixed sodium and potassium hydroxides at temperatures in excess of 100° C....
- ...handling a solution of benzoyl, benzoic acid in benzine saturated with aluminum chloride solution ...
- ...transferring alkaline solutions and saturated aluminum chloride in water solutions.

For detailed information about these Durcopumps, Durco valves, and other DURCO corrosion resisting products, contact your DURCO representative or write.

## THE DURIRON COMPANY, Inc. Dayton, Ohio

BRANCH OFFICES: Atlanta, Boston, Buffalo, Chicage, Cleveland, Detroit, Houston, Knoxville, Los Angeles, New York, Philadelphia, Pittsburgh





ing of interior surfaces of such items as pipe which require corrosion-resistant protection but which must withstand pressures beyond the capacity of polyethylene pipe; flasks and containers with small diameter neck openings, yet whose interiors require corrosion protection; flat but highly irregular shapes such as propellers, mixing blades, coaxial fans and rotors, and the like."

#### Next NACE Annual Meeting

Means of reducing the nation's multibillion dollar annual loss to corrosion will be stressed at the 12th Annual Corrosion Conference of the National Association of Corrosion Engineers. The meeting will be held March 12-16 at Hotel Statler, New York City. Persons from all parts of the world have been invited to participate in discussions and information exchanges on many aspects of corrosion control.

"The need for corrosion prevention is ever increasing and the exchange of fundamental data and practical experience becomes more necessary," said Frank L. Whitney, Jr., president of NACE, when he announced that the conference for the first time will encourage world-wide participation. A variety of discussions devoted to corrosion principles, chemical inhibitors, corrosion problems in the petroleum industry, oil and gas production, chemical industry, steel metallurgy, power and communications, corrosion by high purity water, cathodic protection, high temperature corrosion, plastics, protective coatings, pipeline problems, and instrumentation will be featured. In addition, three educational lectures will be given on: Mechanism of Corrosion Inhibitor Action; Relationship of Thin Films to Corrosion and Techniques of Thin Film Study; and Effects of Velocity on Corrosion.

Meetings of more than 67 NACE technical committees will be held also during the week of the conference.

The 1956 Corrosion Show will be held concurrently with the conference. The Corrosion Show will feature exhibits of latest equipment and techniques for control and prevention of corrosion. Companies throughout the world engaged in the fight against corrosion have been invited to exhibit. Chairman of the exhibits committee is Clark A. Bailey of Johns-Manville Sales Corp., New York.

The National Association of Corrosion Engineers is a non-profit organization of engineers concerned with the problems of corrosion. Founded in 1943 with headquarters in Houston, Tex., the association now embraces most industries having corrosion dealings. Of the present 5,200 or more members, 448 are located in United States Territories and 36 foreign countries.

#### New Aid in Evaluating Welds

After some four years of zealous effort by hard-working industry members of ASTM Committee E-7 on Non-Destructive Testing, reference radiographs covering types and degrees of discontinuities in steel welds have been approved for publication by the American Society for Testing Materials. The reference radiographs are reproduced from master radiographs taken of official sample weld plates which are the property of ASTM. There are 35 radiographs in the form of transparencies mounted in standard 5 by 8-in. Keysort cards. Details of plate thickness, radiographic method, and welding procedures are given on each card. The transparencies, although reproduced to a density level of approximately 1.0, retain the original radiographic contrast.

The reference radiographs are intended to serve as a guide for interpretation. No attempt has been made to establish limits of acceptability for any discontinuity. However, where applicable and upon agreement of all interested parties, they may be used in production inspection to evaluate weld soundness as provided for in product specifications. For identification purposes each type of discontinuity is designated by a number. Degree of severity for each defect is indicated by a letter. Provision has been made for expansion of the card file as new reference radiographs become available.

The complete file of 35 radiographic transparencies can be purchased for \$50 per set from ASTM Headquarters, 1916 Race Street, Philadelphia 3, Pa.

#### Wear at a Glance

A unique new method of corrosion protection for equipment is now being used by the Graver Water Conditioning Co., New York. Graver designs and manufactures a complete line of equipment for the treatment of industrial, municipal and industrial waste waters. The wide range of liquids and chemicals handled by such equipment occasionally calls for special protection against corrosion.

Several excellent coatings have been developed by the paint industry for this purpose, selection depending upon the nature of the corrosive liquid to be handled. The initial coating is applied at time of equipment installation and then reapplied later after normal deterioration and wear. It is this reapplication which sometimes presents a problem since it's not always possible to determine how much protection has worn off or whether certain parts have suffered more wear than others.

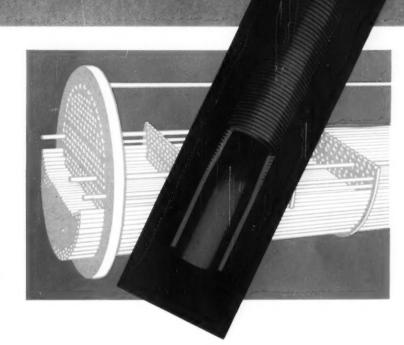
To combat this difficulty Graver applies five to seven coats of paint at installation time using successively different colors for each coat. Thus, as the protective coating wears off the operator can tell at a glance from the color showing just how much wear has occurred, how much protection remains, and which parts or sections have received more wear than others. He will know exactly when recoating of all or part of the equipment is necessary.

Graver has found this system to be highly successful with its solids-contact unit, the Reactivator, for example, is used to treat brine for reflooding operations in the oil fields—also acid wastes from plating operations. Both are highly corrosive. This "rainbow" system has also proved most effective when used with gravity filters and chemical storage and feeding tanks.

HERE'S WHAT WOLVERINE WILL DO FOR YOU ...

### TRUFIN'

- . STEPS UP HEAT TRANSFER EFFICIENCY
- SAVES TIME
- SAVES MONEY
- SAVES VALUABLE SPACE



Yes, if you want more heat transfer efficiency want to save time, money and space—here's a tip for you. Investigate, today, the possibilities of Wolverine Trufin Type S/T condenser tube.

Type S/T is an extended surface condenser tube. Its extruded fins-providing greater heat transfer surface—are actually part of the tube wall. A 3/4 inch Type S/T condenser tube, for example, has an external-to-internal surface ratio of 31/2 to 1. It has approximately 21/2 times the outside surface of the 3/4 inch prime surface tube it is designed to replace. That means increased capacity—more BTU's from every foot of tube.

When an installation tubed with Trufin goes on stream—it stays on stream longer. Because the fins are part of the tube, they can't shake loose from vibration, thermal shock or pressure fluctuations. Actual operating data and pilot plant research indicate that Trufin Type S/T actually resists the

deposition of fouling materials. Maintenance costs go down-and stay down. When specified for new units, Trufin Type S/T permits the designing of smaller, more effective heat exchangers and condensers. You save space and you spend fewer dollars.

Type S/T—when specified as replacement tube packs more heat transfer surface into existing units, steps up capacity far above original output. It can be directly substituted for prime surface tube without any deviation from standard retubing techniques.

And there—in brief—is what Wolverine Trufin Type S/T will do for you. Put it to the test-specify Type S/T—for both new units and when retubing existing units. Wolverine's new Processing Flowsheets Catalog shows exactly where Type S/T is being used and can be used in the industry. Write for your copy-TODAY.

Wolverine Tube, 1443 Central Ave., Detroit 9, Mich.

\*REG. U. S. PAT. OFF.

Wolverine Trufin available in Canada through the Unifin Tube Company, London, Ontario.



## THE CASE OF THE KIDNAPPED CONDENSER



"See that vacant space out there—just to the right of those three condensers. It used to be occupied by No. 4 condenser—but not any more. Good old No. 4 is gone—kidnapped by a piece of licorice.

"What's that you say? It sounds like a mystery story with a trick ending. Well, in a way it is. It all started eight months ago when home office began screaming for more production. I'm telling you our whole engineering department sat up nights trying to figure it out. We just couldn't see how we could boost output—short of building a new plant, that is.

"Then we got our first real break. I'm sitting home one night—dead tired—when Johnny, my five-year old son walks in. Is he a mess. He's chewing on a piece of licorice—and it's smeared all over him.

"I start to take it away from him—when something about that licorice rings a bell in my mind. It's the way it looks—sort of like a piece of tube—with fins!

"Then it comes to me—something a Wolverine salesman had mentioned one day in my office. 'Wolverine Trufin\*,' he said, 'is an extended surface condenser tube with integral helical fins squeezed right from the tube wall. Because of the fins, Trufin has much greater capacity than prime surface tube.'

"That was the clue we were looking for. We pulled a condenser and retubed with Trufin Type S/T. The results were terrific. Right away heat load jumped from 417,000 BTU's per hour to 829,000. You can just bet that No. 2 and No. 3 got the same Trufin treatment. No. 4 got the gate—we just don't need it anymore. You might say that it was kidnapped by Trufin Type S/T—and a piece of licorice."

Next time you retube—specify Wolverine Trufin Type S/T—see how it can solve heat exchange and condensing problems in your plant. Write, too, for the new Trufin Opportunity Book. It's filled with valuable design information and actual Trufin case histories.

Wolverine Tube, 1443 Central Avenue, Detroit 9, Michigan.

\*REG. U. S. PAT. OFF.



## Here's the story...

NEW SMALLER, BETTER MOTORS 1 TO 30 H.P.

> In this revealing book, Century shows how and why the New Standard, smaller motors actually outperform the larger, heavier Old Standard models.

> These trim, compact "New Standards" give you weight savings up to 40%... plus space savings and easier installation. Dead weight and dead air space are eliminated. The "active materials," such as iron and copper, are designed to give greater efficiency than ever before. New synthetic insulating materials give greater dielectric strength and uniformity.



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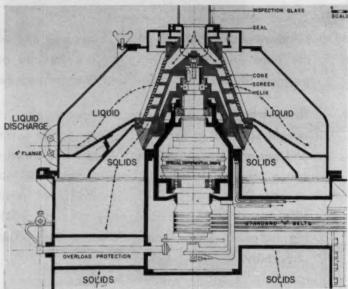


## CENTURY ELECTRIC COMPANY

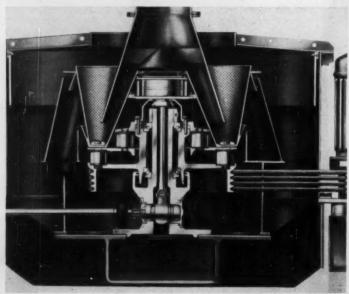
1806 Pine Street . St. Louis 3, Missouri . Offices and Stock Points in Principal Cities

## Two New Continuous Screen Centrifugals

Newly available, two continuous screen centrifugals with proved features simplify separation of solids from liquid, give maximum dryness.



MERCONE discharges solids with differential conveyor, handles fibers well.



BIRD-HUMBOLDT basket vibrates to discharge solids without degradation.

T WO German-designed continuous screen centrifugals have recently been adapted for U. S. application by two American centrifugal manufacturers

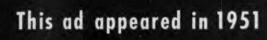
Merco Centrifugal Co. has introduced the Mercone machine, patterned after the German Contessor unit used widely for many years in chemical and food processing throughout Europe.

Bird Machine Co. is offering the Bird-Humboldt centrifugal which within the past two years has demonstrated some outstanding advantages in European service.

Are They Alike-While to the casual observer these machines appear to have basic similarities, they actually are being applied to somewhat divergent processing needs. Merco, with wide experience in applying its well-known nozzle-bowl centrifugal to starch processing, expects the Mercone greatly to improve fiber removal and dewatering in this industry. Bird, on the other hand, looks to dewatering of # in.-100 mesh granular solids as the field where the Bird-Humboldt will improve continuous operations.

Both companies would readily admit, however, that you can't build a fence around either machine; either can be expected to seek out new applications as vendors and processors alike gain experience.

Wrings Out Fibers—Mercone will team up with the standard Merco to give the starch processor a better over-all operation according to H. H. Pomeroy of Merco. Operating at 1,800 x gravity the centrifugal will deliver washed fine fiber containing 80-85% water where shaker screens normally discharge at 95% water content. On coarse fiber, moisture content will be as low as 60%.



... after the pumps had delivered trouble-free service since installation in 1948. As this goes to press the pumps are still running with all original parts. Repair expense continues at zero.

Have you a tougher pumping job than this? vapor bind - and of course that's LaBour. (Notice the sunshades to keep off hot rays which would These pumps - regular LaBour Type BGM with sealed and vented through pipes and air-release valves on account of the fire hazard.

the housings scaled and equipped with explosionthe housings scaled and equipped with explosion-proof motors—are handling alcohol-acetone mix-ation in the management of the management of the solvent would as foot head. The presence of this solvent would make packing hubitation of the make packing hubitation of the management o make packing lubrication extremely difficult make packing indrication extremely dimenti-but all LaBour Type G pumps are packingless,

so there's no proniem at all.

The volatility of the alcohol-acetone solution demands a truly self-priming pump that cannot so there's no problem at all.

induce greater vaporization.) The housings are

Here is another instance that proves LaBour pumps are the answer to the tough pumping jobs. That's why they can be counted on for dependable service on any job.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

THE LABOUR COMPANY, INC. \* Elkhart, Indiana, U.S.A.



#### Bulk Carrier ......252D Equipment Cost Indexes, p. 248 Bag-Patching Tape ......252E **New Process Equipment** New Instruments & Controls Continuous Centrifugals ......242A Gas Density Balance......254A Chiller .......246A Flow Transmitter 254B Electronic Recorder 254C Analog Computer 254D Water Cooler 246B Tower Packing 246C Glassed Reactors ......248A Valve Actuator ......254E Tower Packing 248B Dispersion Mill 248C Leaf Filter 248D New Fluids Handling Equipment Submersible Pump ......256B New Packaging & Handling Equipment Dumpers 250B Hopper Car Seal 250C Checkweight Scale 250D One-Piece Drum 250E Centrifugal Pump 258B Spray Valve 258C Drum Attachment .252A Transfer Unit .252B Turbine Pump ......258D Fittings 258E Filter Cartridge 258F Page number is also Reader Service code number -

For more details, use Reader Service Card

Somewhat similar fiber washing and dewatering operations can be handled also in the processing of pineapples and soy beans. And in all these operations Mercone will consolidate several screening and dewatering stages into one centrifugal separation.

Dinder the Cover—Feed to the Mercone enters at the top, passing onto the inner surface of the rotating conical screen. A helix, rotating at a slightly different speed, moves the draining solids down the screen toward the large end. Because the taper of the conical screen moves the solids gradually farther from the axis of rotation they are subjected to increasing centrifugal force.

Throughput rates vary from 30-50 gpm. for hard-to-dewater material up to 150 gpm. for coarser fiber. According to job requirements, either a 20 or 30 hp. motor is provided for machine speeds of 2,400, 2,800, and 3,200 rpm.

With all process parts constructed of Type 316 stainless steel, machine will cost in the \$12,500-\$13,000 range. Major maintenance cost is for the

punched screen plates with an average life of one month.

▶Bird Discharge Unique—In discussing the outstanding performance features of the Bird-Humboldt machine, F. X. Ferney of Bird points to the method of moving the solids through the machine as the key. Despite being a rotating machine, it combines a screen-type shaking action with centrifugal force. With such shaking or vibrating action there is no need for mechanical scraping or pushing to propel the solids through the machine. Result-machine dewaters solids as thoroughly as do other screen centrifugals, yet doesn't degrade the particles appreciably more than does a vibrating screen.

Units now operating deliver solids with 5-7% surface moisture. Loss of solids through the screen with the filtrate is only 2-3%, which is exceptionally low for this type machine.

Solids throughput handled by the Bird-Humboldt is 70-80 tons per hr. with a power consumption of only ½ hp. per ton. This low power requirement substantiates the claim that little of the energy input is expanded in frictional wear of the screen plates. Hence, screens last five to 10 times longer than in other machines of this type.

Two-Motor Drive—By looking at the cutaway view of the Bird-Humboldt centrifugal you can see that a large motor on the right rotates the screen basket. Driven sheave is supported on central pedestal by two angular-contact roller bearings. Basket is connected to the rotating sheave assembly by rubber buffers that act both as couplings and oscillating springs. Thereby, the pulley does not oscillate with the basket avoiding undue wear of the drive belts.

Shaft driven by a motor on the left is eccentric causing the connecting rod within the central pedestal to move up and down a small fraction of an inch with each revolution of the shaft. Oscillating motion is transmitted to the rotating basket by roller bearing inside flexible coupling at top of conical sealing hood.

Feed enters at top, passes down conical sealing hood, into basket. Solids discharge from top of basket, falling down from



stay on stream at top capacity months longer with the

Ljungstrom® Air Preheater

#### HOW FAST IS "WRITE OFF"?

By cutting turnaround time alone, the Ljungstrom means major savings for you. When you take the other Ljungstrom advantages into account—up to 20% fuel saving . . . more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . consistently higher through-put . . . higher product quality—you can see why a Ljungstrom is paid out in just a few months.

For more complete details on what the Ljungstrom
Air Preheater can do for you . . . for an analysis of the
heat recovery benefits attainable in fuel burning
equipment—call or write The Air Preheater Corporation.

Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold oir.

Slag – primary cause of reduced capacity – can be substantially reduced by the Ljungstrom Air Preheater.

That's because preheated air mixes more thoroughly with fuel. The result is better combustion... and less slag-forming material present in the furnace. Oil tubes stay cleaner... stills stay on stream at top capacity for months longer. As an example, one pipe still in an eastern refinery dropped from 16,000 barrels a day to 12,000 because of slag. Now, with a Ljungstrom and modern high-temperature burners, the still operates continuously at 18,000/20,000 barrels.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

the case to conveyor. Filtrate passes through basket into separate compartment.—Bird Machine Co.; South Walpole, Mass.; Merco Centrifugal Co., 150 Green St., San Francisco 11, Calif. 242A

#### Chiller

Absorption type, produces chilled water from steam.

Using economical sources of heat a new type absorption refrigerating machine for large capacity installations puts out more cooling per unit weight than any other type. Designed to cool at low cost this machine adjusts automatically from full load down virtually to zero with little loss in efficiency.

Machine operates on low pressure steam (12 psig.) produced by an economical fuel such as natural gas from back pressure turbines and exhaust from processing operations.

Unit runs without vibration since there are no large motors or other rotating parts. Together with light weight this feature permits unit to be installed anywhere in the plant, on structural steel or on top of process columns.

Eleven available sizes range from 100 to 700 tons.—Carrier Corp., Syracuse, N. Y. 246A

#### **Water Cooler**

For outside installation without enclosure.

The CenTraVac centrifugal water chillers now are available for outdoor installations without protective enclosures. Modified units in 50 to 800 ton sizes were developed mainly for use at large existing plants where inside space for such an installation is not available.

Changes include weatherproofing the purge unit, control panel, conduit boxes and capacity control mechanism. Electric heaters are provided to prevent condensation. Insulation is waterproofed and weatherresistant paint used on the exterior. — The Trane Co., La-Crosse, Wis. 246B



SIX-foot disk of wire packing is checked by Ralf Hartwell and L. B. Bragg.

## Gas, Liquid Contact on Wire

Knit-wire tower packing combines unusually low pressure drop with good fractionating ability and high capacity.

Stuff a pipe with a rolled-up sweater and you have the rough equivalent of a column packed with Goodloe knit-wire packing. Recently introduced after three years development, the Goodloe packing probably operates with a lower pressure drop than any other packing. Yet, it will handle as much capacity as the bubble tray and boosts the number of theoretical plates in existing columns five to six fold.

Originally the packing was conceived to secure operating characteristics intermediate between high efficiency, low output packing and high output, low efficiency packing. Actually, it combines both high efficiency and high output.

Because of its low pressure drop characteristics, the Goodloe packing is ideal where distillation temperature must be kept low. Applied to the fractionation of higher-boiling organics it does not crack the molecules or form color.

Initially, Goodloe packing was used in laboratory columns. Now, it is operating in commercial sizes. So far, no numerical operating data are available.

It can be applied to a variety of vapor or gas-liquid contacting needs such as distillation, cooling water for air conditioning, stripping, absorption, etc. > Continuous Strand—To form the packing, bunched filaments of wire are knit into a continu-



- The initial high purity of *carbide* acetylene makes purification to *your* exacting standards simple and inexpensive.
- National Carbide's policy is liberal on load factor.
- · Good level construction land at the site.
- · Many other basic chemicals are available from neighboring manufacturer-suppliers.
- Natural gas, plentiful water supply and TVA electric power.
- Illinois Central R.R. and navigable Tennessee River. Near geographical center of the U.S. Favorable rates to all major markets.
- Modern housing and school facilities. Industry-labor relations record is excellent.

A complete up-to-date report on the facilities and advantages of Calvert City is now available. Write National Carbide for a copy of "Industrial Resources, Calvert City, Kentucky."

Prepared by the Joint Civic Industrial Committee of Calvert City,
and the Agricultural and Industrial Development Board of Kentucky.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .





### **National Carbide Company**

General Offices: 60 East 42nd Street, New York 17, New York Plants: Louisville, Ky., Calvert City, Ky., Keokuk, Iowa, Ivanhoe, Va.

NATIONAL CARBIDE COMPANY is a division of AIR REDUCTION COMPANY, INCORPORATED • Principal products of other divisions include: AIRCO — industrial gases, welding and cutting equipment ond acetylenic chemicals • OHIO — medical gases and hospital equipment • PURECO — carbon dioxide, liquid-solid ("DRY-ICE") • COLTON — polyvinyl acetates, alcohols, and other synthetic resins.



KNIT loops contact and split flows.

ous tubular form, then flattened and crimped at an angle. Two such flattened and crimped sleeves are arranged with crimp lines crossing each other. Then, they are rolled together into a pancake or cylinder to fit the column.

Packing contains approximately 95% voids, weighs 25-35 lb. per cu. ft. and is sufficiently resilient to fit snugly against the tower wall. It can be fabricated from any alloy available in fine wire.

▶ How Maze Works — Liquid flows along the bundles of wire which act as capillaries. Due to the snug fit against the tower wall and the capillary action there is no tendency for liquid to pile up against the wall.

Because the packing structure has been knitted, crimped and rolled, bundles of wire cross each other at numerous points. At these points the liquid is sub-divided and distributed to provide excellent mixing action. Apparently, no redistribution is needed.

Vapor flows through the spiral passageways formed by the crimping; also through the open areas of the knitted structure from one crimped passageway to another. Thus, vapor intermixes thoroughly, too.

Since both liquid and vapor streams mix and separate continually, channeling is not possible.

▶ Minimum Support—The rolled pancakes of packing are approximately 6 in. high. They can be set into tower directly on top of each other, supported by subway grating bars 1 in. apart.

Intermediate supports can be located every 10 or 12 ft.

No special diameter tolerances are necessary. Packing may be removed easily for cleaning, and reinstalled in the column with equal ease.—Packed Column Corp., 30 Church St., New York 7, N. Y. 246C

#### Glassed Reactors

In standard 3,000 and 4,000 gal. capacities.

Glassed steel reactors with 3,000 and 4,000 gal. capacities now are available as standard models to reduce fabricating time and eliminate need for special engineering.

New features are incorporated in these larger R series reactors. For operating flexibility nine nozzles from 3 to 10 in. dia. are provided. Drive is supported on the center cover so both it and the agitator assembly can be removed without disturbing nozzle connections.

The 18-in. dia. manhole is located near the side so that it is accessible. Bottom outlet is offset so agitator can sweep settling solids clear of the outlet. Jacket has two sets of five openings on opposite sides. — The Pfaudler Co., 1000 West Ave., Rochester, N. Y. 248A

#### **Equipment Cost Indexes**

Industry

1955

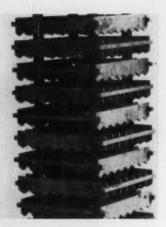
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1955

1010

Avg. of all	188.1	191.0
Process Industries		
Cement mfg	180.2 189.0 175.0 178.6 181.9 182.2 185.6 188.0 186.1	182.8 191.3 177.6 181.2 184.6 184.9 188.3 190.8 188.9
Related Industries Elec. power equip Mining, milling Refrigerating Steam power	190.8 189.9 208.7 178.1	193.6 193.0 211.8 180.7

Compiled quarterly by Marshall and Stevens, Inc. of III., Chicago, for 47 differen industries. See Chem. Eng., Nov. 1947, pp 124-6 for method of obtaining index numbers March 1955, pp. 178-9 for annual average since 1913.



#### Tower Packing

Of carbon grids improves performance on corrosives.

Operating performance far superior to random packings is reported for carbon Paragrid tower packing. Packing can handle most complex acid, alkali and solvent liquors.

Used for absorption, distillation and cooling, Paragrid operates with surfaces wet completely at liquid flow rate of 1,500 lb. per hr. per sq. ft. of tower cross section. For design purposes maximum gas loading adopted is 2,300 lb. per hr. per sq. ft. Under normal gas and liquid loadings H.T.U. is between 1.5 and 1.9.

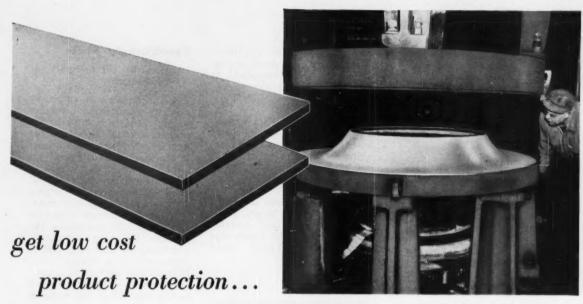
Packing is built up from grid slats that have been preassembled into grid elements. Grid slats are spaced equally. Alternate elements are at right angles. Drip space between elements wets each slat.—Powell Duffryn Carbon Products Ltd., Hayes, Middlesex, England.

248B

Dispersion mill discharges with pressure. Eliminates pump on discharge, permits a closed system and discharge at higher level than feed.—Tri-Homo Corp., Salem, Mass.

2480

New self-cleaning pressure leaf filter has sight ports to permit inspection of individual leaves. Ports can be dogged down quickly when putting the 12,000 gpm. unit on the line.—Hercules Filter Corp., Hawthorne, N. J. 248D



Press-forming a LECTRO-CLAD part. Because the nickel plating withstands normal working pressures, fabricators can use standard steel shop methods and equipment.

## (Fal

with

## Easy-To-Fabricate

## LECTRO-CLAD® Nickel Plated Steel

CF&I LECTRO-CLAD Nickel Plated Steel Products provide positive protection against product contamination and discoloration in transportation, storage and processing operations. That's because this new product is electro-plated with a heavy layer of nickel that's 99% pure. You get the advantages of solid nickel or nickel-clad at far less cost.

What's more, steel fabricators are fast finding that it takes no expensive special handling or equipment to work CF&I LECTRO-CLAD. Because of the high tensile strength of the nickel and the firm nickel-to-steel bond, the nickel plating will withstand working to and beyond the point where the steel itself would fail. CF&I

LECTRO-CLAD exhibits excellent working qualities in die forming, pressing, rolling, flame cutting and welding. It can be sheared or punched with the same equipment used for commercial steel plates.

If you use—or fabricate—heavy industrial equipment where product contamination is a problem, you can probably use CF&I LECTRO-CLAD to good advantage. CF&I manufactures plates, pipe, heads and many fittings in this material. For further details, write for the CF&I LECTRO-CLAD Technical Manual. Wickwire Spencer Steel Division, The Colorado Fuel and Iron Corporation, P.O. Box 1951, Wilmington, Del.

## Claymont Steel Products



Products of Wickwire Spencer Steel Division • The Colorado Fuel and Iron Corporation

Abilene • Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Casper • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston • Lincoln (Neb.)
Les Angeles • New Orleans • New York • Oakland • Odessa • Oklehoma City • Philedelphia • Phoenix • Portland • Pueblo • Selt Lake City • San Francisco • Seattle • Spokane • Tulsa • Wichita
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OTHER CLAYMONT PRODUCTS

3606

Stainless-Clad Plates • Manhole Fittings and Covers • Large Diameter Welded Steel Pipe • Flame Cut Steel Plate Shapes
Flanged and Dished Heads • Carbon and Alloy Steel Plates



Car Mover

## Pulls heavily loaded freight cars, hauls carts and skids.

The new heavy duty Trackmobile hauls, switches and spots railroad cars; can double as a trackless tractor to pull carts and skids around the plant.

Trackmobile travels on roadways or across track on four pneumatic wheels. Placed astride a track, the Trackmobile can retract its road wheels so that within 90 sec. it rests on its steel rail wheels ready for track operation.

Draw-bar pull of the Trackmobile is much greater than its
own weight. After the machine
has been coupled to a car a constant-pressure hydraulic jack on
the Trackmobile lifts the freight
car slightly to transfer some of
the car's weight onto the Trackmobile. Thus, the machine can
develop as much as 12,800 lb.
of draw-bar pull, which is sufficient to pull a number of
heavily loaded cars.

Trackmobile is built for year 'round operation in any climate under the most unusual service conditions.—Whiting Corp., 157th & Lathrop Ave., Harvey, Ill.

#### Dumpers

## Handle variety of dumping requirements.

A new line of PowRdumpers now is offered to handle a range of dumping needs. These units can raise drums, barrels, bags, boxes, trucks, or any type container; can turn the container to any desired dumping angle and discharge the contents, without spilling or dripping, into any type of receptacle at any desired height. Control can be manual or completely automatic.

Three basic models are available. Model 54 dumps loads less than 750 lb. from the front at heights up to 8 ft. Model 36 for heavier loads also dumps from the front but can work up to any desired height. For side dumping loads in excess of 2,000 lb. at any height, model 32 is recommended.—Langley Mfg. Co., Inc., 920 Cambridge St., Cambridge, Mass. 250B



Hopper Car Seal

## Keeps contamination out of shipment.

Extra protection for purity of products being shipped in railroad hopper cars is secured with a new paper hatch cover. Developed by Victor Chemical Works with the assistance of Chase Bag Co., the cover assures Victor's customers of receiving uncontaminated shipments of sodium phosphates. No longer do loose or damaged hatch covers endanger product purity and customer relations.

Cover consists of two sheets of paper laminated with a water-resistant adhesive and crinkled to provide stretch. It is merely set in place over the hatch, then secured by the cover. Also, it can be adapted to hopper trucks, storage bins and silos using hatch covers.—Chase Bag Co., 306 South Franklin St., Chicago 6, Ill. 250C

#### Cheekweight Scale

## Records checkweights of containers.

A completely automatic checkweight scale furnishes weight readings in digital form printed on dual tape with the item number printed adjacent to the weight. It will print out total weight of the combined items whenever desired, will handle bags, drums and cartons.

System consists of two units: a weighing conveyor assembly and a console containing the printer. Weighing element is a strain-gage load cell. Cell is supported by a flexural platform so that only vertical components of force are transmitted to the cell. Thus, inaccuracies due to side or off-center loading are eliminated.

Checkweigher will handle up to 15 units per minute, can give either "over" or "under" alarms and control conveyor.—Weighing Components, Inc., 64 Fulmor Ave., Hatboro, Pa. 250D

#### One-Piece Drum

#### Easier to set up and handle.

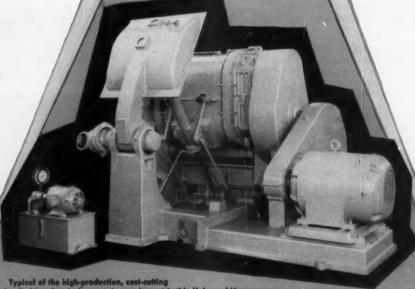
A new one-piece octagonal drum can be assembled at point of filling with three to five stitches, saves 20¢ per hundred drums freight cost. Simplified set-up process saves labor and material and improves inventory handling.

Drum is 23% in. high by 13 in. dia. Made of 30-point kraft, drum features a special release coating which facilitates removal of contents. Presently, it is being used for shipping 100 lb. packages of asphalt. An efficient glue joint is attained with a special heat- and water-resistant glue.—Gaylord Container Corp., 111 North Fourth St., St. Louis 2, Mo. 250E

For More Information . . . about any item in this department, circle its code number on the Reader Service

Postcard inside the back cover.





Typical of the high-production, cost-cutting
Baker Perkins chemical processing equipment is this Universal Vacuum
Mixer, size 15 TWEM. Working capacity 100 gcillons; total 175 gallens.
Constructed of Stainless Steel, jacketed for 125 psi heating or cooling.

## BAKER PERKINS INC.

Chemical Machinery Division • Saginaw, Michigan

#### Drum Attachment

Fits all fork-lift trucks, operates without power.

With a new crab attachment that fits all trucks on the market present fork-lift equipment can be modified at minimum cost to handle drums. Unique design utilizes gravity to grab, hold and release drums or containers without power.

Device can be installed on present equipment within a matter of minutes. Design is sufficiently simple so that need for maintenance is said to be eliminated completely.

Unit can break out tightly nested drums and handle even badly dented or tilted drums. Arms hold and lift at rolling chimes or top rims. Bottom rolling chime can be used as support surface to achieve up to 12 extra inches of stacking height.—Kughler Development Corp., Material Handling Specialties Div., 230 Park Ave., New York, N. Y.

#### Bag Packers

For valve bags, are flexible, pack rapidly.

A new line of valve-bag packing machines that embodies the most advanced developments now is available. Packers offer high packing speed and good flexibility for handling various bag sizes.

These packers are custom designed to coordinate service to many industries served by Fulton Bag & Cotton Mills, who manufacture the bags.

The Ful-Pac machine uses a screw to move and deliver the materials. All models are encased completely within easily removable steel jackets to provide maximum safety and protect the mechanical parts.

Models include a popularpriced single spout packer, a deluxe single spout machine and a twin spout unit—Fulton Bag & Cotton Mills, 170 Boulevard Elas, S. E., Atlanta 3, Ga. 252C

#### **Bulk Carrier**

Delivers bigger loads faster with less maintenance.

Offering fully hydraulic operation the new model SF-5, bulk material body can unload up to 1 ton per min. Material can be discharged into grills or hoppers or onto the ground. Or if desired, the swivel conveyor can be used to discharge 15 ft. above the ground or higher.

The hydraulic operation is controlled from rear-of-body positions. One control valve regulates the speed of the body conveyor and the cross feed auger. The other valve controls the speed of the vertical and discharge augers.

Dicharge stack is elevated by hand pump. Stack is swung by hand crank and gear.

Model SF-5 is built in lengths from 10 to 34 ft., truck or trailer mounted, with chain and flight or belt discharge.—Baughman Mfg. Co., Jerseyville, Ill. 252D

#### Transfer Unit

Automatically handles cylindrical loads between conveyors.

An automatic transfer unit now is operating to transfer rolls of paper from a belt to an overhead trolly conveyor. It can be applied equally well to the transfer of bales, drums, rolls and other loads that can be rolled.

Unit consists of a section of grooved live-roll conveyor which is mounted on a carriage at the end of a conveyor run. When the load has moved on to the carriage-mounted section of live-roll conveyor it strikes a limit switch that stops the conveyor.

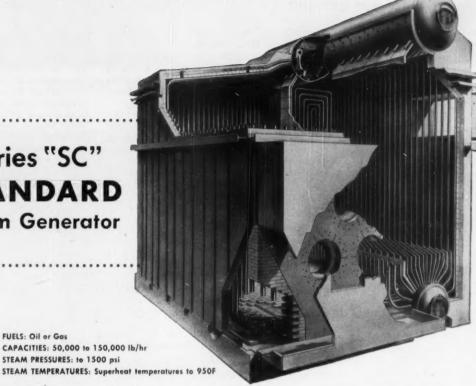
Section of carriage-mounted roll conveyor then moves sideways out of the conveyor line until it touches an empty car waiting nearby on the overhead conveyor. Then the roll conveyor section tilts to roll the load onto the car. A large cushioned bumper on the far side of the car snubs the moving roll.—Lamson Corp., Syracuse 1, N. Y. 252B



Pressure-Sensitive Patch Mends Punctured Bag

Down near the bottom of a tiered pallet load, this punctured bag of powdered material is repaired with minimum effort and cost. After the dust has been brushed away from the hole a patch of No. 131 Behr-cat Flatback pressure-sensitive tape is applied directly over the tear.

Then, any remaining particles are removed with a damp cloth. Repair is completed by applying second overlapping layer of tape. Tape has tensile strength of 45 lb. and adhesive grip of 65 ox. per in. of width.—Behr-Manning Div., Norton Co., 1933 Sidford St., Troy, N. Y. 252E



# Series "SC" STANDARD Steam Generator

FUELS: Oil or Gas

# PRE-ENGINEERED FOR SAVINGS

in first cost, installation, operation, maintenance

Series "SC" Steam Generator is of the pre-engineered, standardized design, with all exterior and structural details fixed. Available in nine sizes, with capacities of 50,000 to 150,000 lbs steam per hr, it incorporates many advanced design features - as noted in the accompanying list - that make possible important savings in industrial steam costs.

Burners, controls, upper drum mountings and other equipment requiring attention are located at the

front of the unit. Heat recovery equipment and fans can be placed near the operating aisle for either single or multi-unit installations, providing unusual accessibility and ease of oper-

Write us today for further information on how the Series "SC" Standard Steam Generator can meet your individual plant needs for power or process work. Foster Wheeler Corporation, 165 Broadway, New York 6, New York.

## FEATURES AT A GLANCE

- Completely water-cooled furnace
- · Over 19-foot firing depth
- Unrestricted circulation
- All-welded casing
- Fully drainable superheater
- Efficient convection surface
- · Bottom supported unit
- Steam purifying system
- Full insulation

FOSTER WHEELER

NEW YORK . LONDON . PARIS . ST. CATHARINES, ONT.



# Gas Density Balance

Measures gas by unique null balance principle.

Employing a null balance concept the new Gas Density Balance measures continuous samples or samples as small as 10 c.c.

A small dumbbell is supported on a horizontal quartz fiber. One ball of the dumbbell is punctured so that it will not react to buoyancy effects. The other ball tends to rise and dip as the density of the gas increases or decreases.

As the dumbbell seesaws on the fiber it creates a rotational force that varies with the density of the gas. However, an electrostatic force acts to keep the dumbbell in a null position. This balancing potential, proportional to the gas density, operates a meter mounted on the door of the balance.

Response of 95% is obtained in less than one minute. Sensitivity is ½% of full scale; accuracy is ½% of full scale. Available with variety of range spans relative to air anywhere from 0 to 2.000.—Arnold O. Beckman, Inc., 1020 Mission St., South Pasadena, Calif. 254A

#### Flow Transmitter

Has working parts isolated from process fluid.

Differential pressure is transmitted instantaneously and accurately by the new Fig. 1575 pneumatic force-balance flow transmitter. Adjustable damping built into the unit mini-

mizes pulsation and vibration effects before they reach the transmitting section of the instrument. Unit also is stable to pipe strain, static pressure, temperature, position and random flow signal noise.

No working parts contact the process fluid. Fluid pressures are exerted on smooth outside surfaces of two diaphragms which transmit pressure differential through a sealed-in oil chamber between them. Output air pressure, proportional to the pressure differential across the high pressure diaphragm, is transmitted to an indicator recorder or controller.

Range of the transmitter is continuously adjustable from 0-20 to 0-200 in. of water; output is 3-15 psig.—Fischer & Porter Co., Hatboro, Pa. 254B introduced is the first inexpensive and highly flexible analog computer that offers a high degree of accuracy.

Computer comes in kit form, thus saving the large labor and overhead costs included in the total cost of previous machines. Basic reason for low cost and flexibility are use of a standard voltage reference supply and a dividing network.

Layout of the amplifiers keeps plugging and wiring to a minimum. A unique patch board layout enables the operator to see his computer block layout.

Available after January 1st, 1956, computer is expected to sell for under \$700.—Heath Co... Benton Harbor, Mich. 254D

## Electronic Recorder

Cuts recorder expense, eliminates special charts.

A new electronic receiverrecorder for d.c. type pickups and d.c. telemetering systems can combine four records on the same uniformly graduated chart. Also, it can record from a.c. pickups or pneumatic transmitters.

Recorder may house as many as four, plug-in, d.c. receivers, or two receivers and two pneumatic controllers. Non-linearity inherent in many pickups is extracted by a characteristic cam in the receiver. Thus it is that four records can be combined on the same chart.

The d.c. receiver operates on the potentiometric null-balance principle, using an electronic voltage reference rather than the conventional standard cell and battery. This makes it unnecessary to interrupt measurements in order to standardize.—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio. 254C

#### **Analog Computer**

Available in inexpensive kit form.

No longer is the analog computer a high-priced tool. Just



#### Valve Actuator

Operates plug valves on remote location.

Remote plug valves are operated by the compact, self-contained Robotarm valve actuator. This diaphragm-operated, double-acting mechanism works through a rack and gear assembly.

Only one instrument air or gas line is incorporated in the Robotarm. Gas pressure moves the actuator forward and at the end of the stroke automatically charges the built-in accumulator.

When pressure is released, the accumulator reverses the actuator and then automatically exhausts itself. Thus, pressure on the diaphragm equalizes at the end of each stroke, a fail-safe operation is assured and instrument line piping is minimized. Gas operating pressures of 15 to 100 lb. are required.—Bettis Corp., 320 South 66th St., Houston, Tex. 254E

# It never gets too salty for U.S. Uscolite Pipe!



chlorine and hydrogen.

Controlling highly corrosive brine was a major problem for a Providence, R. I., maker of chlorine products. The brine attacked the piping and replacements had to be made every 6 months. In addition, corrosive fumes shortened the life of another piping system in the plant.

Then U.S. Uscolite® Plastic Pipe was installed. Result: no signs of corrosion of any kind, in either piping system-even after over a year of operation. Savings in piping replacement and maintenance will continue for an indefinite time.

A product of United States Rubber Company, U. S. Uscolite Pipe has great impact strength. Yet it's very light in weight. It's available also in pipe fittings, valves, and sheet stock for fume ducts-will resist acids, salts, alkalies and gases, inside and out.

For replacement or completely new piping, get in touch with any of the 27 "U.S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

Uscolite pipe and fittings are made in the broadest and largest line of stock sizes on the market. Sizes follow:

- Molded fittings in ½" through 4" I.P.S. Molded flanges ½" to 6" I.P.S. • 1/2" to 3" Uscolite diaphragm valve (Hills-McCanna).
- Pipe in standard wall dimensions and extra heavy wall dimensions in 1/2" through 6" pipe sizes.



**Mechanical Goods Division** 

Uscolite pipe carrying sodium hypochlorite to a

storage tank lined with U. S. Permobond® cor-

rosion-resistant lining.

# ited States Rubber



# Spray Nozzle

Does not clog, is self cleaning.

Employing flexible orifices a new spray nozzle is claimed not to clog regardless of the amount of fine suspended matter carried into the orifice. This nozzle will be standard on all Carrier spray-type air conditioners.

Nozzle is fitted with a flexible diaphragm. If lint or other foreign material catches behind the orifice, water pressure builds up immediately within the nozzle. In turn, the diaphragm stretches enlarging the orifice so that the retained particles are dislodged. For medium pressures, nozzle is made in two sizes; the smaller model also is available with a low pressure cap. Caps, which contain the non-clogging diaphragm, will fit many existing nozzles. - Carrier Corp., Syracuse 1, N. Y.

#### Submersible Pump

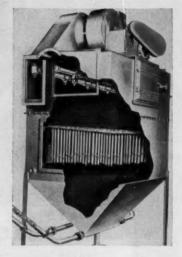
For demanding, industrial booster service.

Designed to meet industrial requirements, the Verti-Line submersible booster pump is well suited to typical sump, line-booster, fire-protection, and barrel-pumping installations.

Pump has an oversize shaft, longer-than-usual bearings with protective caps, perihedral impeller seals, mechanical shaft-seal designed specifically for submerged service, and choice of either mixed flow or radial flow impellers. Submersible mo-

tor has a large oil reservoir and a spring-loaded resilient bag that permits the sealed motor to breathe as pressure and temperature change.

Models available from 5 to 150 hp. with discharge head 50 to 500 ft. and 100 to 4,000 gpm. capacity. — Layne & Bowler Pump Co., 2943 Vail Ave., Los Angeles 22, Calif. 256B



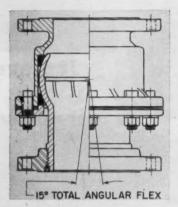
## Gas Scrubber

Removes low-micron fumes and odors.

A new dust control unit, the Type A hydro precipitator scrubber, removes microscopic solids, fumes and odors from exhaust gases. Efficiency up to 99% is reported with dust loadings of five grains per cu. ft. and 70% of the solids below 5 micron particle size.

Dust is collected by forcing the exhaust gas through a multiple tube system into a water chamber. This method produces a highly efficient scrubbing action. The violent agitation of the water causes additional scrubbing action in the tube chamber.

Scrubber comes in 15 sizes with capacities ranging from 500 to 40,000 cfm. Sludge can be removed constantly or intermittently by manual, hydraulic or mechanical means. — The Johnson-March Corp., 1724 Chestnut St., Philadelphia 3, 2566



# Ball Pipe Joint

Is lighter, stronger, costs less.

New ball pipe joint now is available in 8-, 10- and 12-in. sizes. Joint provides 15 deg. angular flexing and is unaffected by exposure for 45 min. to 950-1,200 F. temperature, resulting from fire.

These pipe joints either with 150 or 300 lb. flanges, or welding ends are suitable for 600 psi. steam and operating temperatures up to 1,000 F. There is a choice of general purpose, corrosive service or high temperature gaskets.—Barco Mfg. Co., Dept. J-1, 500 Hough St., Barrington, Ill. 256D

#### Gate Valve

Operates smoothly, needs little maintenance.

All-new gate valve is claimed to overcome disadvantages inherent in conventional gate valves. Already proven in the field by major refineries and chemical plants, the new valve shuts off the line impenetrably, both on the upstream and downstream side of the wedge.

Impassable contact of the precision-machined wedge and valve-body seats is backed up by a pair of Teflon packing seals pressing against the wedge to form a further barrier. Stainless-steel locking rings and seats make the valve impervious to corrosives moving through the line, it is said.—Hamer Valves, Inc., Box 1851, Long Beach 1, Calif.

"THE BRAND OF PROGRESS"



▲SYNOPSIS OF AD #9: In its design and manufacture of all types of heat exchangers, Western Supply exerts rigid quality control over raw materials, machining, assembly, and testing. Typical of these procedures is periodic X-Ray of the work of the entire welding crew to assure consistent weld quality. This procedure is, of course, over and above the regular weld X-Ray of critical fabrication points as required by the various construction codes.

By Heat Exchanger Specialists



Within recent years rising material and labor expenses have greatly increased the cost of heat exchangers. For this reason, Western Supply's pioneering and experience in low-finned tube construction constitutes one of the company's most impressive stories in customer service.

Finned tube construction has the one big advantage of giving approximately  $2\frac{1}{2}$  times the heat transfer surface on the tube. For a great many applications this can mean either smaller exchangers or fewer exchangers - - - with resultant economies to the customer.

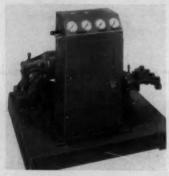
Western engineers, believing in the ultimate success of finned tube design, proceeded with research and experiments eventually leading to a considerable amount of finned tube fabrication. Now that finned shell-and-tube units are receiving wide-spread acceptance, Western holds an advantage in having left the testing stage behind.

The above is but one example of Western's operational versatility. In the realm of thermal and mechanical design, the company builds equipment for temperatures as low as minus 100°F. . . as high as 1600°F - · · for pressures as high as 4,000 psi . . . as low as 65 millimeters mercury absolute. These figures are not limiting and Western stands ready to tackle any thermal or mechanical problem.

# WESTERN HEAT EXCHANGERS

WESTERN SUPPLY COMPANY P. O. BOX 1888 . TULSA, OKLAHOMA

HUDSON-RUSH COMPANY—753 Gladstone Blvd., Shreveport, La.
130 Casa Linda Plaza, Dallas 18, Texas
PROCESS INSTRUMENTS & EQUIP. CO.—North Bldg., Charleston, W. Va.
H. W. SEVERANCE—Marion E. Taylor Bldg., Louisville, Ky.



# Controlled Pump

Adjusted by instrument air to correct delivery rate.

Stroke length of a controlledvolume pump now can be controlled by tieing pump into pneumatic process control systems. Using this new combination, specific low-capacity flowcontrol problems can be solved.

Pump utilizes a unique airservo system with feedback loop to adjust capacity within 1% accuracy over 0-100% range. Variation in control air pressure as small as 1/70 lb. causes re-setting of the pump stroke length.

Components of the pneumatic servo system are housed in a cabinet mounted on the pump base. Key air pressures are indicated on gages; actual stroke length is shown by a dial on the pump.—Milton Roy Co., Station N, 1300 East Mermaid Lane, Philadelphia 18, Pa. 258A

#### Centrifugal Pump

Has unique new patented impeller design.

A completely new, patented centrifugal pump has a diverging type impeller that handles liquids with high concentrations of solids, air and gases. Unique design prevents vapor binding, avoids clogging, makes the pump self-venting and self-regulating.

In pulp and paper mills, new pump will handle stock up to 10% consistency compared to 5% handled by the conventional centrifugal pump. Solids-bearing liquids can be handled in chemical or food plants without damaging the solid particles.

Also, pump maintains flow even when process calls for injecting large quantities of air into the pump suction.

Secret of pump performance is a diverging impeller with few blades and a correctly proportioned casing. Impeller width increases from the center to the periphery resulting in greater area at the discharge than at the inlet. Result—material is ejected from the periphery at a rate faster than it can enter the inlet. Thus a low pressure zone forms between the blades.

Entrained air or gas will enter the low pressure zone and pass through the pump without binding. Also, pump handles solids and slurries without abrupt acceleration and with lower velocities through the impeller and casing.—Ingersoll-Rand, 11 Broadway, N. Y. 4, N. Y. 258B



#### Spray Valve

Makes deaerating heaters and hot process softeners more efficient.

A completely new type of spray valve provides a constant flow angle under all conditions. A specially constructed parabolic plug produces an unvarying, even spray pattern at pressures and flow rates ranging from 3 to 150% of rating.

Valve is made of corrosionresistant stainless steel, is nonsticking and requires no maintenance. Thoroughly proven in exhaustive pilot and actual plant tests, it is now an exclusive feature in all Graver deaerating heaters and hot process softeners. — Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y. 258C

## Turbine Pump

For cold process work has mechanical seal.

Special turbine pump, type Z4, has been developed for cold process applications and for handling liquid ammonia, liquified petroleum gases and various chemicals. Design incorporates a mechanical seal subject to suction pressure only.

Pump-end can be separated from frame assembly which facilitates the use of special alloys for all parts in contact with the liquid being pumped. Materials of construction can be iron, iron fitted with bronze, all bronze and special alloys for chemical applications. Capacities from 5 to 60 gpm. at heads from 0 to 350 ft.—Aurora Pump Co., Div., The New York Air Brake Co., Aurora, Ill. 258D

Fittings for polyethylene pipe are injection molded from rigid unplasticized polyvinyl chloride. Presently available in polyethylene-to-polyethylene couplings and polyethylene-to-metal adapters, 4 and 1 in. — Wilmington Plastics Co., 810 South Heald St., Wilmington, Del. 258E

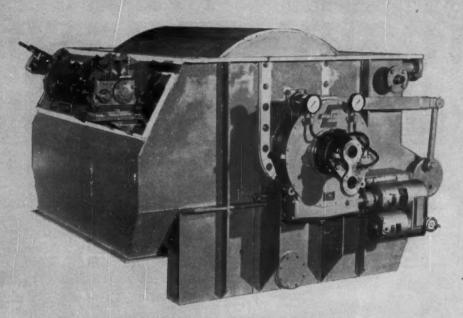
Filter cartridge in 2, 10, 25 and 50 micron grades is fabricated of fibrous glass for high chemical and temperature resistance; fits standard filter containers.—Porous Plastic Filter Co., Inc., 30 Sea Cliff Ave., Glen Cove, N. Y. 258F

For More Information . . .



about any item in this department, circle its code number on the Reader Service

Postcard inside the back cover.



# **Absolute Purity of Product Maintained with Eimco Filters**

Absolute purity of product is maintained when using Eimco continuous vacuum or pressure filters. The picture above illustrates one of the many Eimco filters being used by industries that must maintain absolute purity such as antibiotics and other pharmaceuticals, food and allied industries and chemical industries.

To meet the requirements of these industries, Eimco makes all filters to specifications produced by cooperative efforts of the customer's engineering staff and Eimco's Research and Development engineers.

The filter shown above is a high submergence type filter designed for use with precoating material. The drum is all type 316 stainless steel and the tank is of mild steel with ¼" thick PVC

lining. The lining is carried out through flanged connections and bolt-on-assemblies so that the white PVC material is visible from the outside. This filter is equipped with the Eimco Hyflow automatic valve for greatest efficiency in operation and the Eimco knife advance mechanism.

All of these features are significant to the type of application for this particular filter. Your problem receives the same detailed consideration by Eimco engineers who are specialized in filtration equipment. That is the reason Eimco filters work better, last longer, produce more and require less maintenance, square foot per square foot, than any other filter.

Write for more information on your specific problem.

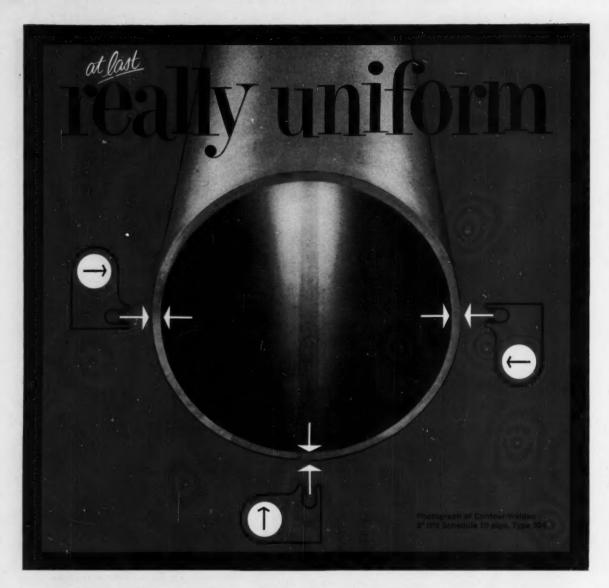
# THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

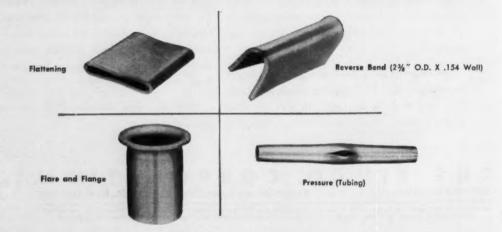
New York, N. Y. Chicago, III. San Francisco, Calif. El Paso, Tex. Birmingham, A.ia. Duluth, Mian. Kellogg, Ida. Baltimore, Md. Pittiburgh; Pa. Saattle, Was Pasadene, Calif. Houston, Taxas Vancosver, B. C. London, England Gatsshood, England Paris, France Milen, Italy Johannesburg, South Africa



8-162



# CONTOUR-WELD PIPE...BEST BY ANY TEST YOU CAN NAME



# stainless pipe

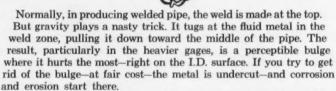
# ...by Trent's new Contour-Weld process

Trent's new, patented *Contour-Welded®* stainless pipe and tubing gives you all the uniformity of wall thickness you'd expect in welded pipe and tubing – plus equal uniformity in the weld zone itself.

This new-type welded pipe is so smooth, so uniform, that the weld is almost imperceptible. What's more, with no bead or undercut, localized corrosion or erosion is eliminated

... physical properties are better than those of any other pipe, welded or not.

But try Trent's new Contour-Welded pipe or tubing yourself. As a matter of fact, ask for a sample – and give it any test you like. That's the quickest way to see for yourself why Contour-Welded pipe and tubing outperform any other. And it's made by Trent – tube mill specialists.



# Why Trent's Exclusive Contour-Weld Process Means Smoother Welds . . .

But Trent put a stop to that—simply by going into partnership with gravity. With their exclusive *Contour-Welding* process, they weld at the bottom—and gravity works for them. For then, the bulge is in the opposite direction—blending in perfectly with the contour of the pipe itself.



TRENTWELD

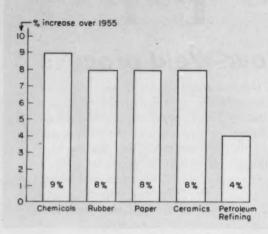


\*Contour-Weld is the trade mark of the Trent Tube Co. for its process of welding pipe and tubing which is protected under U.S. Patent 2,716,692.

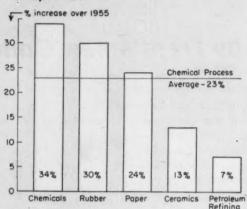
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# 1956 Sales Outlook Dazzles and...



# Capital Spending Will More Than Keep Pace



# Still Another Record Chemical Year Ahead

Chemical processing industries can forget the production, sales and spending records set in 1955. They'll probably all be topped in the coming year.

Douglas Greenwald, McGraw-Hill Dept. of Economics

This year the chemical process industries will produce more, sell more and spend more than in any previous year. In fact, they will show the way to all industry as the nation's economy beats even its phenomenal performance of 1955.

According to a recent McGraw-Hill survey:

• Sales will be up 8% on the average for the chemical processing industries; up 9% for chemicals and allied products; up 8% for rubber, paper and ceramics (stone, clay and glass); and up 4% for petroleum refiners. Remember, sales in each of these industry groups hit all-time highs in 1955.

For all manufacturing, sales are expected to average 7% higher in 1956; every major industry will benefit.

Sales of chemicals and allied products topped \$23 billion in 1955—up 20% over dollar volume of sales in 1954, the best previous year. If expectations are realized, sales of chemicals and allied products should add up to more than \$25 billion in 1956.

• Value of output of the chemical processing industries should hit another all-time mark. It may go as high as \$70 billion in 1956, compared with \$66 billion in 1955, itself a record year. Physical output of chemicals and allied products should lead 1955 by 11%—as much as 1955's edge over 1954—to reach the highest level ever.

• Spending will be jumped 23%—to \$3.5 billion—by the chemical processing industries. This is less of a rise than that expected for all manufacturing

(30%), but more than for all industry (13%).

The chemical industry proper plans to spend \$1.4 billion of that \$3.5 billion total, a third more than in 1955. Petrôleum refiners figure a capital outlay of \$825 million, the largest amount (by 3%) ever budgeted by this sector of the petroleum industry. Spending by paper and rubber firms will be up 30% and 24%, respectively, to all-time peaks. The ceramics group will increase capital expenditures the least of any of the chemical processing industries—only 7%.

For all these industries except the chemical, which spent \$1.43 billion in 1953, 1955 was the greatest spending year ever experienced.

▶ Even More Spending in 1957—McGraw-Hill survey results indicate the new boom in capital spending will most likely carry on into 1957. About three-quarters of the reporting chemical processing companies already plan to equal or exceed their 1956 expenditures in 1957.

Nearly half (46%) expect to

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UNUSUAL DESIGN for a chemical manufacturer. Note angle of ends of the 839 copper tubes. Fixed and floating heads are aluminum bronze. Photo from Camden Copper Camden, N.J.

TWO COPPER mixers, used for coating and blending powder. Made by Camden Copper Works, including the rotating

These two pictures show the versatility of Revere Copper. One, made for a chemical company, contains 839 copper tubes, and an unusual feature of the design is that the ends are cut at an angle. The fixed and floating heads are aluminum bronze. The other photograph shows two copper mixers, which rotate and are used for blending and coating powder. They are much like equipment employed in making coated candies.

These are examples of the special adaptability of copper. Both items were fabricated by the Camden Copper Works, Camden, N.J., which manufactures equipment to individual designs. Like Revere, it offers technical collaboration. It is an important Revere customer.

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#### 1956 Capital Spending Up Again

	1954 Actual	1955 Estimated (Million Dollars)	1956 Planned	% Increase, '56 vs. '55
Chemicals	1,130	1,032	1,383	34
Paper	455	492	640	30
Rubber	131	152	188	24
Stone, clay, glass	361	461	493	7
Petroleum refining	800	728	825	13
Chemical process total	2,877	2,865	3,529	23

spend the same in 1956 and 1957. But at least 25% plan higher spending levels.

The long-run outlook is particularly bright for chemicals, rubber and paper. In chemicals, 44% of the companies plan to boost spending in 1957; one-third of the paper and rubber firms will do so. In only one segment—ceramics—is the proportion of the companies expecting to up investment small (only 4%).

It's important to note that, historically, most companies underestimate their investment plans for more than a year in advance. In fact, spending in 1956 may be higher than plans now indicate since many companies didn't complete their budget reviews for 1956 until after the McGraw-Hill survey was made. So spending plans for both 1956 and 1957 may be increased during the year even in the face of a shortage of capital goods capacity.

▶ Production in '55—Last year's chemical output, as measured by the Federal Reserve Board's index, hit new peaks in almost every month. Production for the year was up 11% over 1954, with the gain spread pretty evenly throughout the year.

Total industrial production—output of all manufacturing and mining industries—increased about the same percentage as did chemicals over the year. But 1954 was a recession year for the economy as a whole, whereas the chemical processing industries enjoyed a pretty fair twelve months.

▶ Behind Chemicals' Boom—The extremely rosy outlook for the chemical processing industries in 1956 can be traced directly to the fact that total industrial activity is expected to hold at very high levels throughout the year. Higher consumer incomes and

tax cuts in 1956 add up to tremendous purchasing power.

Gross National Product (value of all goods and services produced in the country) will probably average about \$405 billion for 1956-up \$18 billion over 1955. And each successive quarter in 1956 will run ahead of the preceding quarter, just as in 1955. But total gain won't be as great this coming year as it was last year. Between the first and fourth quarters of 1955, GNP jumped \$21 billion. For this year the gain from the first to the last quarter will be about \$12 billion.

Government spending will go up a little during the year. Federal spending will likely stay the same as in 1955, although, since 1956 is an election year, there's a good chance that additional spending may go into boosting farmers' incomes. But state and local purchases will run about \$1.5-2 billion higher in 1956.

Private investment will gain modestly—about \$5 billion, Con-

struction will continue to top the previous year's figure as it has done for the past 11 years. And this despite an expected decline in the number of new houses started. Producers durable equipment should rise about \$3.5 billion.

Inventories in 1956 may not play as dominant a role as they have in the past few years. It seems likely that inventories changes during the coming year will be roughly the same as last

Consumer spending will go right on up in 1956. Auto makers expect slightly lower sales, but appliance makers are very optimistic. Consumer expenditures for durable goods should average close to \$34 billion, compared with \$36 billion in 1955. But soft good sales and consumer spending on services will rise considerably. Spending on nondurables (food, apparel, drugs, etc.) will jump about \$8 billion in 1956. And spending on services, transportation, medical, education and the like will go up about \$4 billion.

Chemicals Win—Almost all industries that are important chemical consumers expect to do better in 1956 than in 1955—particularly rubber, paper, food, textiles, construction, railroads and machinery. So it's no wonder that the chemical industry is certainly heading for a new series of sales, production and spending records in 1956.

#### INDEXES

(1935 = 100)

Business Activity	Oct.	1955	317.1
Chemical Consumption		1955	289.4 254.6 254.4

#### Chemicals by Industry

	Sept. (Prelim.)	Aug. (Rev.)		Sept. (Prelim.)	Aug. (Rev.)
Fertilizer	60.76	45,71	Textiles	10.52	10.84
Pulp & paper	34.70	36.47	Coal products	12.12	12.04
Petroleum refining	29.14	30.56	Leather	4.21	4.29
Iron & steel	18.13	17.60	Explosives	9.98	10.70
Rayon	30.10	29.92	Rubber	7.30	6.94
Glass	25.28	28.79	Plastics	24.87	22.46
Paint & varnish	32.05	33.09	Total	299.16	289.41



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# Drug Industry Sales, Profits Soar

	19	54	19	55*	
	Sales N	let Profit	Sales No	et Profit	Net Profit
	(Million	Dollars)	(Million	Dollars)	(% Increase)
Abbott	88.1	8.7	93	9.7	11
Lilly	122.3	11.3	128	14.5	28
Merck	145.5	12.6	156	16.4	30
Parke, Davis	109.9	10.5	120	12.5	19
Chas, Pfizer	145.9	15.2	158	15.5	2
Schering	19.4	1.6	44	6.9	330
Smith, Kline & French	65.4	9.3	90	17.5	88
Total	695.8	69.2	789	93.0	34

<sup>\*</sup> Chemical Engineering estimates

# Drugs in '55: Sensational

Paced by two spectacular chemicals, ethical drug sales volume in 1955 outstripped 1954 by 15%. Even nicer: industry profits were up nearly 30%.

#### Donald R. Cannon, Assistant Editor

You can't point to just one firm or one product as most responsible for the ethical drug industry's banner year just ending. But you can point to two of each: Smith, Kline & French, and its unique tranquilizing drug, chlorpromazine; and Schering Corp. and its safer, more potent hormone, Meticorten (prednisone).

When all figures are in for 1955 you'll find Schering's and Smith, Kline's total sales up by \$25 million each, mostly as a result of enthusiastic acceptance of their new drugs.

That's more than half the total gain of \$95 million estimated for the seven industry leaders (see chart above) who account for over 70% of ethical drug sales. And by the time you add in the other companies you may well find total ethical drug sales over \$1.1 billion—nearly 15% above 1954. Even more significant is the net earning comparison: \$93.0 million in 1955 for these seven firms vs. only \$69.2 million in 1954.

Many Products Gain—Many drug firms showed good sales-earnings increases in 1955. And several products did it.

Reserpine, the powerful alkaloid hypertension agent, with \$50 million in world sales, continued to gain. Swiss-owned Ciba Pharmaceutical, the pioneer in reserpine (accounting for 26% of Ciba's 1954 sales), is still profiting by the drug's success, as are Pfizer, Penick, Squibb and others who came into the picture more recently.

Tetracycline, whose ultimate future is still snarled in a patent wrangle, is making money for Bristol Labs, Pfizer, Lederle, Upjohn and Squibb. Upjohn and Pfizer are now marketing the same or a similar drug to Schering's Meticorten and are beginning to tap this new lucrative market. Parke-Davis' sales pickup was due largely to its part in the Salk vaccine program, a part that enhanced the firm's prestige (which was unfairly tarnished a few years ago by the false Chloromycetin scare). Lilly's success with diethyl stilbestrol as a feed supplement and Salk vaccine spiced its 1955 sales. ▶ Public Relations Problem-Actually, the Salk vaccine, while it directly involved just a small segment of the drug industry,

was very important to the pres-

tige of the whole industry. For the industry's motives and methods were on trial just as surely as were those of the vaccine's promoters.

What looked early like a nightmare (worsened by an inordinate amount of publicity) turned out pretty well as the final analysis (which received much less publicity) showed the vaccine to be effective and practically benign. That most of the vaccine makers performed nearly flawlessly in the face of fierce, nervepopping pressure and admitted laxity in government public health standards is tribute enough. It almost certainly augurs better public relations for the entire industry in the future.

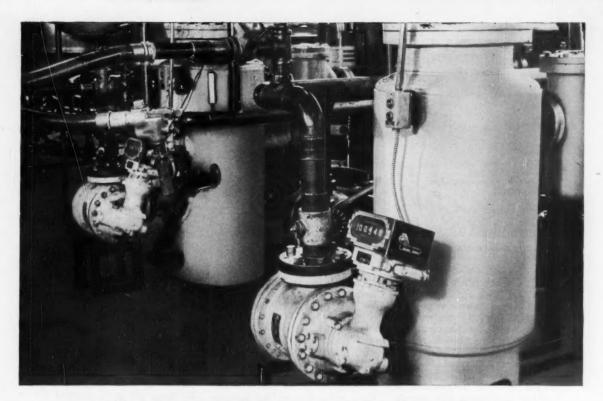
Still, many in the industry are wary of the next time, the time a real cold remedy or cancer cure or heart saver is discovered and demands are made to produce it at all costs. Compounding this uneasiness, too, are the ever-present spectres of federal distribution and the first murmurings of socialized medicine in which all products are identical regardless of origin of manufacture.

► Look for Anti-Virals—The Salk vaccine is of more than immediate importance. For it is the first practical result of the tissue culture technique that won a Nobel Prize in 1954. This method is the key to ultimate victory over virus diseases. We can now study not only the virus in action but also the action of drugs against them.

▶ Bright and Gloomy—Antibiotics had a mixed year. Production of penicillin, the bellwether, dropped following the piledriving 1954 total of 477 trillion units. In the first eight months of 1955 penicillin output was 17% below a comparable period in 1954. And for the year 1955 it will be no more than 400 trillion units.

The lag is a combination of decreasing exports, increasing use of other antibiotics and adjustment to actual sales demand now that the government stockpile capacity of 600 trillion units has been reached. However, further bulk price cuts this year may help.

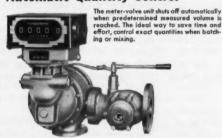
Streptomycin and dihydrostreptomycin: ahead of 1954's total of 587,000 lb. (8-month



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Max. Flow Rategpm	Min. Flow Rate	gpm
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Company		
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City	Zone State	

#### **Drug Production in 1955**

	1954	1955*
Vitamins: Still Moying Up	(Thousan	nd Pounds)
A	116	122
Bt	259	200
Be	24	30
C	1,800	2,100
Niacin	2,200	2,200
Antibiotics: Some Weak Spots		
Penicillin (trillion units)	477	400
Streptomycin & Dihydrostreptomycin	587	622
Sulfas: Still Skidding	4,100	2,500

<sup>\*</sup> Chemical Engineering estimates

total was 6% better than in 1954). Expect 622,000 lb. total for 1955. These antibiotics may be reaching a plateau, what with exports slipping 4% for streptomycin and 7% for dihydro in the first six months, and increased numbers of tubercular-effective drugs being discovered.

Other antibiotics generally gained in 1955. Tetracycline is getting acceptance and there's a constant flow of new antibiotics for specific illnesses. Exports were off considerably in the first six months, but combined output of all antibiotics should be ahead of 1954's total of 1.8 million like.

► Hormones Jump—A big \$12 million business (at manufacturers' level) in 1954, hormones got a powerful shot in the arm in 1955 from the newer cortical hormones that are more potent and less toxic than either cortisone or hydrocortisone, the hormone leaders. Schering picked up the best part of its \$25 million rise in sales from these newcomers. There's no telling just how high hormones sales have gone in 1955. But you can bet on more than \$20 million. Prompted no doubt by appearance of the newer hormones, hydrocortisone makers shaved its price 15% late in the year.

Vitamin Business Healthy—1955 was awfully good for vitamins. Ascorbic acid (vitamin C) and riboflavin (vitamin B<sub>2</sub>) by virtue of drastic price cuts in 1954 have apparently met the competitive challenge offered by German and Japanese manufacturers. Riboflavin held its own in production and ascorbic probably hit 2.1 million lb. in 1955, more than 15% over 1954.

Niacin production was steady at 2.2 million lb. But thiamine derivatives (vitamin  $B_1$ ) didn't do so well. Imports from Japan helped cut production 15% in 1955 to about 200,000 lb.

Increased use of pyridoxine (B<sub>a</sub>) in baby foods, coupled with a recent 16% price slash (the first since 1948) to meet foreign competition, helped that vitamin hit a production of 30,000 lb. in 1955, a jump of 25% over 1954.

Vitamin A output was up at least 5%—to 122,000 lb.—in 1955, partly because more stable forms were offered. Beta carotene (a combined coloring agent and vitamin A substitute) enjoyed a 20% price cut due to a new synthesis method.

A real sleeper is vitamin B<sub>12</sub>, which became the vitamin industry's biggest sales value at \$19 million in 1954—up 33% over 1953—and possibly \$22 million in 1955. All this from sales in 1954 of just 292 lb.

▶ Others Vary—Aspirin, still a solid seller, had a good year: 9% better than 1954 for the first eight months, more than 15 million lb. for the year 1955 vs. 14 million the previous year.

But sulfa drugs kept heading down, may have been as much as 40% off 1954 production. Look for no more than 2.5 million lb. in 1955. However, there may be brighter times ahead, thanks to the same antibiotics that have been most responsible for sulfa drugs' slide. Reason: doctors are prescribing more and more antibiotic-sulfa drug combinations.

▶ Troubles Overseas—Far more pressing than the problems of any one drug product is the impact of revitalized drug in-

dustries in Europe and elsewhere. The trouble is not that more drugs are being imported here, but that these foreign industries are hurting our export trade by supplying their own domestic needs and by exporting to non-U. S. countries.

To meet the challenge, American drug makers are moving major sections of manufacturing, processing and packaging to overseas subsidiaries. Sales of these subsidiaries already equal the export volumes of many U.S. drug firms, will pass them soon.

The export markets are in effect becoming domestic markets. Pfizer, for instance, with as big a stake in foreign operations as anyone, now owns plants in England, Canada, Brazil, Belgium and the Phillipines. It shares—with native partners—plant ownership in France, Germany, Italy, Spain, Sweden, Australia and Japan. Basic manufacturing plants are in England and France, with more planned for Argentina and Chile.

There's benefit, too, in competition abroad. Some progressive foreign firms are feeling the pinch of their own countries' rules and regulations designed to keep outside investors within bounds. So foreign government policy, particularly on patents, is becoming more liberal to U. S. and native processors both.

Another source of foreign competition exists right in this country—the foreign-controlled drug houses like Ciba and Hoffmann-La Roche which do 10-15% of U. S. drug business.

► Tariffs No Problem—Little change is expected in the present tariff picture since few sensitive drug chemicals are on the tentative list of products for which tariff concessions may be offered. The only medicinal in the tariff spotlight-and the first in recent years—is para amino salicylic acid, used in tuberculosis treatment. It's being investigated by the Tariff Commission on application of Sumner Chemical and American Cyanamid. The two complainants say that halving of import duties in 1951 has put American PAS producers at an increasing disadvantage.

► A Look Ahead—Antibiotics will move ahead but not just in the direction of medical usage.



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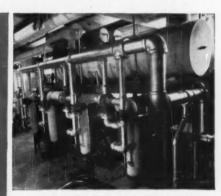
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#### ECONOMICS . . .

About 700,000 lb. of antibiotics in 1955 went into animal feed supplements alone. So it's not surprising that some predictions say that in the future 90% of all antibiotics will be used for plant disease control, feed supplements for animals and plants, food preservation and other non-pharmaceutical purposes.

Sulfa drugs, on the skids these past few years, may brace as they're found more effective combined with antibiotics, hormones and other popular sellers.

New anti-virus drugs will be aimed particularly at colds and cancer. And enzymatic processing techniques will spawn a host of steroid-based compounds for better treatment of endocrine disorders.

Look to mental chemotherapy as a potent force in the development of new medicinals. Chlorpromazine and reserpine have shown the way to perhaps an eventual \$500 million business.

Medicines are helping people live longer—and thereby create new problems in helping these old people keep healthy and useful. Geriatics, the treatment of the aged, will test the ingenuity of the drug industry as it has never been before.

# GUIDED TOUR CONTINUED



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# COMING SOON

Submerged Combustion: What, Where, Why. Feb. Proper Design Minimizes Painting Costs. Feb. Design and Use of Barometric Condensers. Feb. Pressure Vessels With Integral Flat Heads. Feb. Fundamentals of Applied Statistics. Mar. Design of Overhead Pipelines. Mar. Problems in Handling Liquefied Gases. Apr.

## Turbines cut process costs.

Operating on waste gas, expander turbines supply two-thirds of the compression power in this new Mississippi Chemical nitric acid plant rated at 220 tons per day. (p. 274)



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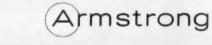
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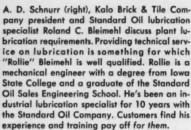
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Large open gear, such as this one in Kalo Brick & Tile plant, suffered excessive gear tooth wear until their Standard Oil man suggested switch to CALUMET Viscous. New lubricant eliminated throw off, reduced gear replacement and maintenance.

# CALUMET Viscous Lubricant solves gear lubrication problem for Kalo Brick & Tile Company

Long-time Standard customer receives another demonstration of effectiveness of Standard Oil Products and technical service.

The Kalo Brick & Tile Company, Fort Dodge, Iowa was experiencing trouble with the lubrication of open gears. The lubricant used lacked adhesive qualities and was being thrown off resulting in excessive gear tooth wear. In addition, the lubricant had to be heated before application.

As they had done in so many cases during sixty-five years as a Standard Oil customer, Kalo management called in a Standard industrial lubrication specialist. Inspection and recommendation by the Standard man resulted in a switch to Calumer Viscous Lubricant for open gears. Kalo Brick & Tile Company got these results: gears received an effective shield that did not throw off, life of gears was lengthened and lubrication throw off, life of gears was lengthened and lubrication greatly reduced, no preheating of Calumer Viscous Lubricant was required so this messy job and the preheating equipment were eliminated.

No matter what the problem, chances are Standard Oil lubricants and technical service can help you solve it. Try them. Call your nearby Standard Oil lubrication specialist in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.



Kalo Brick & Tile Company plant, Fort Dodge, lowa found solution to gear lubrication problem by using CALUMET Viscous Lubricant.

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- Not a residual product but a true grease carefully manufactured from selected soaps, oils and additives.
- Good wetting ability. Gives lubricant superior adhesiveness, makes it resistant to washing.
- Has very high load-carrying capacity.
   CALUMET Viscous grease formula is especially designed to provide effective shield under heavy load.
- Resistance to heat. Since it is a true grease compound, CALUMET Viscous has extreme stability, does not thin out under high heat.

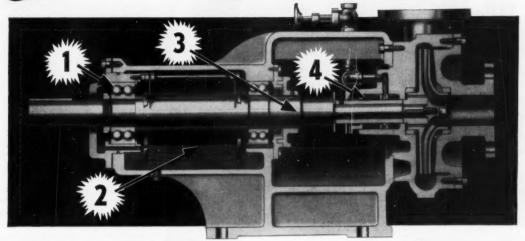


STANDARD OIL COMPANY

(Indiana)

# Oil-Lubricated Chemical PUMP

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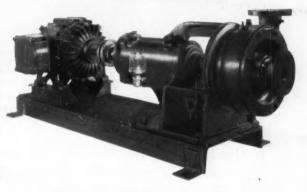


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- 2. Oil lubrication which does away with the most common cause of bearing failure overgreasing. Oil lubrication also permits operation at higher temperatures.
- 3. Heavy shaft—holds alignment, reduces wear of parts. Either high grade carbon steel or stainless steel is provided, depending on application. Pump can be supplied with or without shaft sleeve as desired.



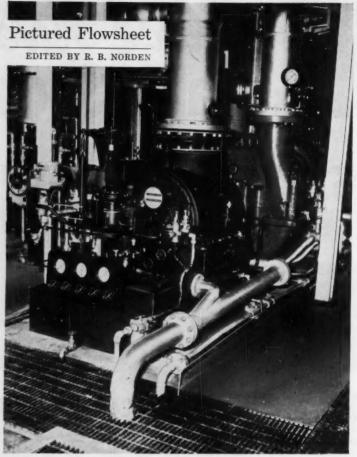
**4.** Alternate sealing arrangements — Any one of six different sealing arrangements can be provided, including a water-cooled stuffing box where the liquid being pumped is above 250 F.

Allis-Chalmers builds many types of pumps, but this particular type is recommended for pumping liquors, corrosive materials and solutions in the most used ratings to 3500 gpm, heads to 400 feet for liquids to 550 F.

For complete information call your nearby A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin, for Bulletin 52B7638.

# **ALLIS-CHALMERS**





Turbine-driven centrifugal compressors spark . . .

# New Trend in HNO3 Plants

Moving into chemical processes, expander-turbines supply 66% of the compression power in this new plant.

AS expander-turbines, long tied to jet propulsion and power generating plants, are catching hold in the chemical process industries.

For the immediate future, the big application will be as power recovery units, driving centrifugal compressors in new nitric acid plants using the Du Pont ammonia oxidation process. According to one expert: "It's simply a question of economics—expander turbines cut down external compression power requirements, and compression of air is a big part of the expense of running a nitric acid plant."

From almost all standpoints the nitric acid process seems ideally suited for expanders. A high-temperature, high-energy content gas (from the acid absorber) is available for expansion; at the same time power is required to compress a reacting gas. But, say the advocates, there are a number of other chemical processes just as well set-up for turbines: acetylene, ethylene, methanol, tonnage oxygen, ethylene oxide and ammonia.\*

\* Not much has been done in chemical processing, but the gas expander turbine is a well established feature (since 1936) of the Houdry fixed-bed catalytic cracking process for high octane gasoline.

In some cases the process can act as the combustion system, adding energy to the gas, while in other situations burners would be required.

► Gas Turbine in Operation— At Mississippi River Chemical's \$1.4 million spanking-new nitric acid plant, at Selma, Miss., the process itself adds energy to the turbine gas.

The plant, designed and constructed by The Chemical and Industrial Corp. of Cincinnati, is the largest single ammonia oxidation unit in the U. S.—rated at 220 ton/day of 100% acid. It features two 8-ft. long, Clark Bros. turbine-driven centrifugal compressors (Brown-Boveri, Westinghouse, Worthington and General Electric make similar units).

Each compressor is directly connected to a gas expander-turbine, which supplies two-thirds of the compression power—a steam turbine provides the

remaining one-third.

The gas turbine has 11 stages, runs a' 3,500 rpm. It expands waste gas from the acid absorption column (about 80% of the original air) at 80 psig., heated to 900 F. by the reaction products from the converter. The gas exhausts at 350 F. and 0 psig. ► High Temperature: No Limitation-This high temperature (900 F.) operation is a big feature of turbine expanders. Reciprocating compressors haven't been neglected in the power-recovery-conscious nitric acid industry, but lubricating requirements have held the operating temperature of reciprocating expanders down to 500 F.-severely limiting potential power recovery. Actually, reciprocating compressors require an aftercooler, but have a high over-all efficiency, and until a few years ago were recommended for ammonia oxidation units smaller than 80 tons/day. Now smaller. efficient centrifugals are available for 50 tons/day units.

The power recovery advantages of turbines show up sharply at Mississippi Chemical where 160 kwh. net power consumption is required per ton of 100% acid, at rated capacity.

Reciprocating compressors take 480 kwh./ton and reciprocating expanders knock this down to 240 kwh. Centrifugal compressors alone would call for a whopping 490 kwh./ton. What About Compressors?— At Selma, the two-case compressor is fitted for diaphragm cooling.\* The first case discharges at 40 psig. and has five stages. The second is at 120 psig., has four stages.

Actually there are two expander-compressor units operating in parallel, each handling 12,000 scfm. of air. A centrifugal compressor surges below 60% of design capacity, so two compressors allow the plant to operate at low production rates and provide insurance against shut down.

Other Process Improvements
—Anhydrous ammonia (from an adjacent ammonia plant) is vaporized and filtered to remove oil, which is poisonous to the platinum-rhodium catalyst. Filtration is through a bed of activated alumina (see flowsheet).

Ammonia then mixes with preheated, compressed air to give a 10% ammonia mixture at 110 psig. and 535 F. This passes over the gauze catalyst. At 1715 F. ammonia oxidizes to nitric oxide. Reaction products are partially cooled by heat exchange with waste gas from the absorption column and with incoming air. This stainless heat exchanger is designed to use a single shell with a U-tube bundle at each end. The incoming air passes through a jacket around the shell.

Reaction gases are further cooled in a cascade cooler to about 85 F. Here nitric oxide oxidizes to nitrogen dioxide. The water vapor condensed here absorbs some of the nitrogen dioxide, forming a weak acid which refluxes to the absorber.

Cool gas passes into the 50-ft. high, 10-ft. dia. stainless steel absorption column equipped with bubble cap trays. Here nitrogen dioxide is absorbed in condensate water as the gas passes up the column, forming 58% nitric acid for  $NH_4NO_3$  fertilizer.

Additional air is introduced at the base of the column for bleaching the product and for reoxidizing the nitric oxide released in the absorption reaction.

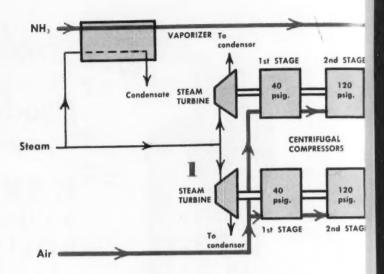
Process Requirements — For every ton of 100% nitric acid the following are consumed:

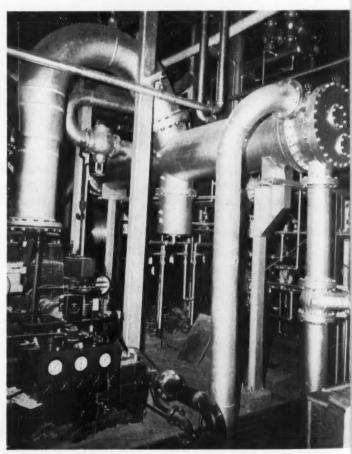
580 lb. anhydrous ammonia

160 kwh. power

800 lb. water

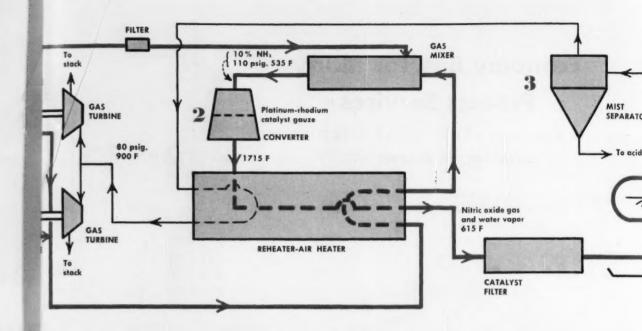
0.005 oz. catalyst

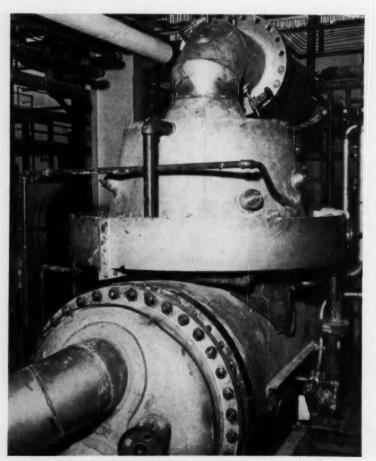




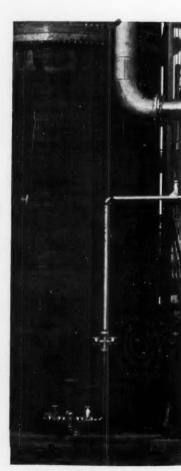
STEAM TURBINES (condenser shown above) supplies one-third of the power required for driving the two Clark centrifugal compressor

<sup>\*</sup>A type of jacket cooling. Each diaphragm or volute is provided with a water jacket along the gas passage.

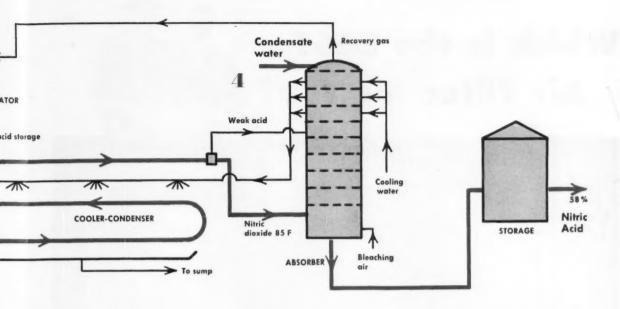


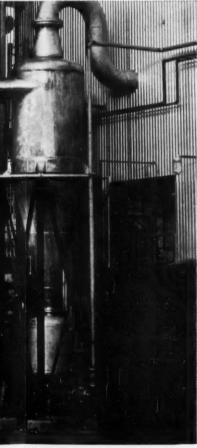


2 CONVERTER contains a platinum-rhodium catalyst. Here ammonia, mixed with air, is oxidized at 110 psig and 1715 F. to nitric oxide.

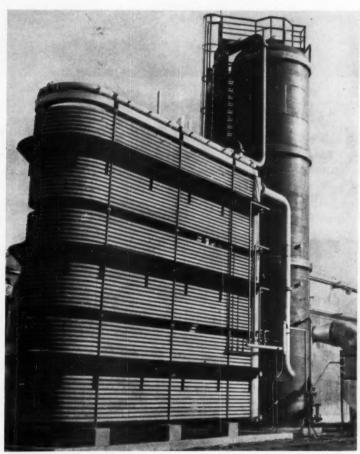


MIST SEPARATOR removes a absorber. The dry gas, preheat



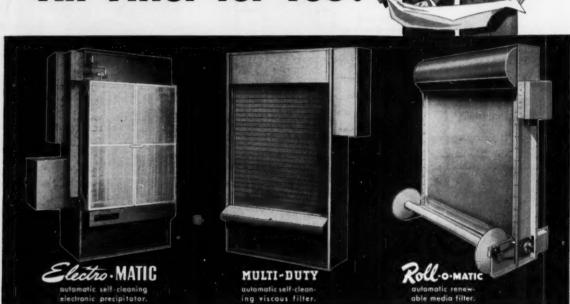


es acid from the waste gas coming off the neated, is sent to expander-turbines.



4 COOLER-CONDENSER and 10-ft. by 50-ft. absorption tower stress the fact that this is a single unit 220 tons/day nitric acid plant.

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And within each category, AAF offers filters which feature four distinct methods of maintenance —(1) filters that are automatically self-cleaning; (2) those that are reconditioned by washing; (3) those that feature renewable media, and (4) throw-

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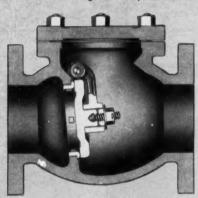
Herman Nelson Industrial Heaters

# Economy Buy for Many Process Services

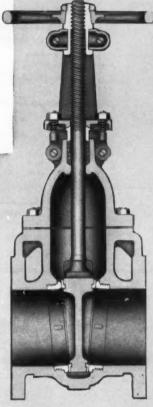
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12 in. and smaller—200 psi W.O.G. 14 in. and larger—150 psi W.O.G.



Cross section, Check, No. 14493 Flanged ends



Cross section, Gate, No. 14477 Flanged ends

# Crane Nickel Cast Iron Valves IMMEDIATE DELIVERY from Factory Stocks

Why wait for low nickel alloy cast iron valves when you can get Crane quality—at no extra cost—immediately from factory stocks? Gates on hand in sizes: 2"-2!/2"-3"-4"-6"-8"-10"-12"-14"-16"-18". Checks in all the same sizes up to 12" incl. (14"-16"-18" will be made to order). This delivery offer good while present stocks last.

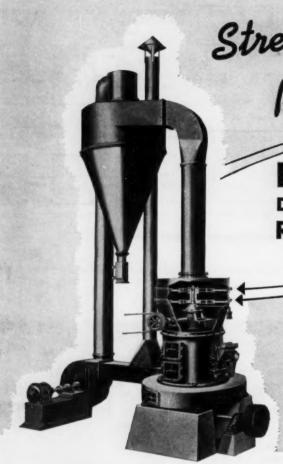
These valves have an outstanding record in the pulp and paper industry in handling various alkaline liquors. In wood treating they're used successfully on creosote vapors and oils. They're ideal, in the petroleum industry, for handling oils containing traces of mineral acids. Crane 18-8 SMo alloy trim in these valves combines with nickel alloy body to assure tight seating and smooth, maintenance-free operation. The gates have Crane features such as: full-length disc guides...2-piece ball-type gland...T-head disc-stem connection.

The checks feature all 18-8 SMo trim, including body ring, disc, hinge and hinge pin in sizes 2 to 12 inches. Valves 14 inches and larger have disc same as body, with 18-8 SMo disc faces.

You'll save with these valves on original cost and maintenance. Call a Crane Representative for immediate delivery! Crane Co., General Offices, Chicago 5. Branches and Wholesalers in all industrial areas.

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Streamline your Production!

RAYMOND
DOUBLE WHIZZER
ROLLER MILL

Close fineness control
Clean dustless operation
Rapid moisture removal
Pneumatic feed control
Air cooling and conveying

THIS compact mill system combines in one simultaneous process the functions of several different units. The result is a streamlined operation that saves floor space, simplifies plant layout, avoids rehandling materials and speeds up production.

In making fine chemicals, pigments, nonmetallic minerals, fillers and many special materials, the Raymond Whizzer-type Roller Mill gives close control of the finished product in fineness, dryness and uniformity. When the mill is equipped with Flash Drying accessories, a definite percentage of surface moisture may be removed while pulverizing.

You will find that Raymond Roller Mill economy is an important factor in your production. Ease of installation, low cost operation and maintenance, as well as pneumatic feed control which keeps a maximum "load" on the mill at all times, all add up to substantial savings that reduce your overall costs.



For further details, write for Raymond Catalog No. 79



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# Thomas M. Ware: Man of the Month

Engineer becomes administrative vice president of International Minerals & Chemicals Corp.

"Captaining a tandem bike is very much akin to my new job," observes Tom Ware. "Unless everybody's efforts are well coordinated, there's a whole lot of wasteful wheel-churning . . ."

"But, frankly, mastering the bike seemed a good deal easier than my present attempt to transfuse some of engineering's newest techniques into management's bloodstream."

▶ Breaking Through the Line—An engineer by degree, a planner by instinct, Tom feels that planned coordination—now popularly called Operations Research—is a mighty logical approach to the future of any aggressive company. "Industrial engineering remained a foundling for too many years before people finally understood it and made a place for it in management."

Now, they know how well it can study and predict a project's alternative possibilities. And, they know, too, that its greatest promise is the fact that it takes into consideration uncontrolled chance factors. "An attitude, a technique, an openmindedness—it is, probably, the most dynamic approach to business thinking."

► Calling the Plays—Ware reminds us, though, that he's not alone in his enthusiasm for the technique. Even football coaches use a form of it when they devise a number of possible defense stratagems in advance. That way, they're prepared for a variety of offensive tactics that can't be forecast before gametime. Some coaches have even used electronic brains to work out these plays.

Nevertheless, it is basically

an engineering approach. And Tom Ware's record is a history of using it to good advantage.

Only last year, while still IMC's VP of engineering, Ware applied "Opsearch"—as he calls it—in a mining equipment design assignment. The out-moded inefficient cab from which the operator had to control an enormous dragline shovel bothered Ware's sense of design and challenged his imagination.

He thought it ironic that a man should drive to work in a car equipped with the latest precision-controlled instruments and conveniences and then spend the rest of the day trying to cope with equipment of Model-T caliber! His car had power steering, brakes, a clear view, a radio, a heater—even air-conditioning; the dragline had none of these things—though any of them would have helped him do a better job.

Ware's new \$1 million cab design gives the operator optimum visibility, comfort, simpler controls and radio contact with his crew on the job's progress. To do it, he combined biomechanics, climatology and visual effects in his Opsearch study. It was a revolution in design.

▶ New Strategy — Actually, though, the real revolution was in techniques and profit potentials. Opsearch was not intended to be confined to the immediate realm of a specific performance problem. And so, last summer, Tom Ware geared its inquiry into the entire system of mining and processing.

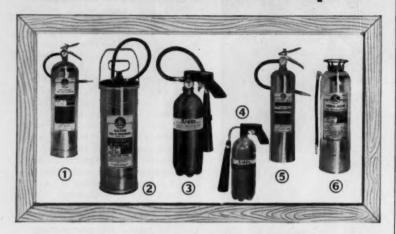
As a result, the scientific method has been set to synthesize all the separate process steps from the mine to the mill and to "optimalize" labor and capitol for a greater profit. Especially, from now on, mine-mill management will pay more attention to process economics (following the lead of the CPI).

Training Table—Almost everything in Ware's business

Training Table—Almost everything in Ware's business background seems to have dovetailed him for his new job. That's why, he has a suspicion that, subconsciously, he'd always aimed for it.

He left Cornell, in July 1940,

# NOW! Brand-New Extinguishers Make Kidde Line Most Complete!



Efficient, dependable and superior in design, the new expanded line of Kidde extinguishers now makes it easier for you to choose the right extinguisher for every fire hazard!

- 1. Water and anti-freeze. Now available either air-pressurized or cartridge-operated, in either brass or stainless steel, 2½ gallon capacity.
- 2. Pump tanks. 2½ and 5-gallon sizes, in either galvanized or polished copper tank. Removable all-brass double-action pump throws 40-foot stream.
- 3. Dry chemical. Air-pressurized in 5 or 10-pound capacities, cartridge-operated in either 20 or 30-pound portables. 150-pound capacity wheeled unit for large hazards.
- **4. Carbon dioxide.** Portables in 2½, 5, 10, 15 and 20-pound capacities, in either trigger or squeeze-valve models. Also wheeled units in single-cylinder capacities of 50, 75 and 100 pounds.
- 5. Vaporizing liquid. CTC or CBM, pump or air pressure operation with seamless drawn brass shell. Pump capacities 1 to 1½ quarts, pressurized capacities 1 and 1½ quart or 1 gallon.
- 6. Foam and soda-acid. Seamless drawn brass or stainless steel shell, in 2½ gallon size. Also available: 40-gallon soda-acid and foam wheeled units.

For more information on these and other extinguishers in Kidde's new expanded line, write today for the new Kidde P-8 catalog.

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NAMES . . .

as a graduate ME. The next two years, spent on the drafting board at Lockheed, injected the spirit of the aircraft industry—a flair for new and different things and the will to try them out. There at Lockheed, one of his projects was the development of the first .50 cal. turret.

▶ Young Coach—Tom's natural bent toward planning and development was recognized by his boss and resulted in a recommendation for a spot with the Radio Plane Co. As chief engineer, he directed development of the first mass-produced radio-controlled target drone. Here, his experiences in taking on production and managerial problems kindled Ware's interests in better businesss techniques.

A two-year stint in the Navy's Special Devices Unit drove home the necessity of fitting equipment to the needs of the operating man. It was his job to adjust cockpit and instruments to the pilot. He soon gained a sharp and respectful insight into the limitations of human beings. (Incidentally, to this period we can trace his inspiration for the airplane-like "stick" controls he designed for the dragline shovel.)

Later, his diversified work for a management consulting firm (Geo. Frye & Assoc.) reinforced his ideas about the import of industrial economics. "There's no basic difference," he believes, "between a dragline and a screw-machine. To operate either, at a profit, you've got to reduce shutdowns, equipment changes, and aim at maximum operating use."

▶ The Fans—In March 1942, a pretty (see cut) lyric soprano playing in light opera on the West Coast, became Mrs. Tom Ware. Now, three daughters—Sherryl, 11; Bonnie, 8; and Marianne Lyn, 2—enliven the rambling ranch house which the Wares occupy on a one-acre plot in Winnetka, Ill.

Many of Tom's hobbies are centered around his family. Even his boyish enthusiasm for 10-mile-a-day bike rides has carried over to take a place in family life. Their tandem bike, a souvenir of Italy, is a favorite and will soon be crowned with an extra saddle for Marianne Lyn (when she can reach the pedals).

Final Score-Ware's new job is just what any young man with his imaginaiton and background might have in mind. Although much of his enthusiasm for it stems from the fact that he'll still be able to "keep his hand in engineering," he is also, potentially, a capable administrator. (He's now director of the Executives Club of Chicago.) And, his conviction that "no single department should be emphasized over any other" point up his aim to achieve a valuable coordination of all divisions.

Ware's admitted skill in engineering projects and, most of all, his insight into the intangibles: into men's minds and technologies sum up the dual reason for his latest appointment.

Louis D. Scott is the new supt.
of Chemstrand's acrilan plant
in Decatur, Ala. Until 1952,
Mr. Scott had been associated
with Standard Oil in Illinois.

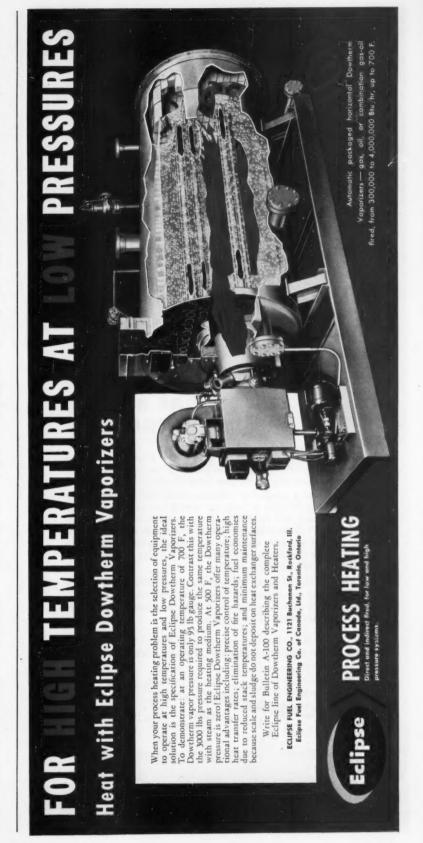
Carlton W. Crumb has been promoted to the new post of director of technical data for Dorr-Oliver.

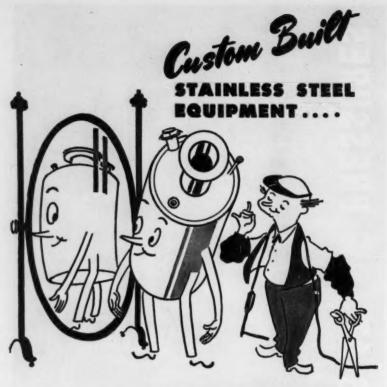
Nat C. Robertson has been appointed director of research for Escambia Bay Chemical. Formerly, he had directed petrochemical operations at Nat'l Research Corp.

John Fennebresque has joined Food Machinery & Chemical as VP and asst. to the president. For the past 10 yrs. he has been with Celanese.

Robert Kich, formerly with Dow Corning, has joined the diene synthetic rubbers section at Goodyear. E. M. Katt has been transferred to the bench-scale piloting section, of the research div.

G. Shepherd and C. Floyd have been promoted to section head and senior research chemical engineer in Humble Oil's res. & dev. section. T. E. Peterson





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We work exclusively with stainless steel and alloys. Our plant is specially tooled to fabricate this metal. Our engineers and mechanics are particularly trained for the work. Why not consult us when you plan your next stainless steel vessel?

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NAMES . . .

is the new general foreman of the Baytown refinery's distillation department.

John C. Garver has been appointed asst. prof. of chemical engineering at the U. of Illinois.



Stewart P. Coleman

A Texas-born chemical engineer—Stewart P. Coleman—has been elected a vice president of Standard Oil of N. J.

Coleman joined the Jersey firm in 1920 and, since 1946, has served as a director of the parent company. Last year, because of his interests in petroleum economics, he became chairman of the coordination committee—Jersey Standard's agency for long range study of operations.

Arthur Christian has joined American Viscose Corp. as safety engineer. For the last 10 yrs. he held a similar position with Merck.

W. R. Stephens has been named manager of Barnard & Leas' new department of agricultural and general chemical processing plant design.

Victor E. Cole is the new VP and asst. general manager of Kaiser Gypsum Co., Inc., in Oakland.

John S. Hayes has been appointed director of the engineering dept. of Monsanto's research and engineering div. Keith Eckberg and David Ho-Feng Liu are new members of the research dept.

Maurice F. Dufour has been elected VP of Nicaro Nickel Co., subsidiary of Freeport Sulphur. Mr. Dufour will take charge of nickel and cobalt orebody development in Cuba

- Lloyd Vogel and James B. Edwards will work on detergent development and edible process and product development, respectively, for Proctor & Gamble.
- R. Lamont has been elected a director of Socony Mobil Oil. Mr. Lamont will be in charge of Socony's research & dev. program and its labs. Wm. Holaday will become coordinator of new product planning.
- K. H. Rowland has been appointed works manager of Carbide and Carbon Chemicals. He has been with the firm for more than 20 yrs.
- Bert Cremers and Ford Ballantyne, Jr. have been elected to the board of directors of Wyandotte Chemicals. They are also VP and general manager of the firm's Mich. Alkali div. and J. B. Ford div., respectively.
- Sydney N. Stokes has been elected the 59th chairman of the Drug, Chemical, and Allied Trades section of the N. Y. Board of Trade.
- Harry A. Kimbriel, marketing VP of Eli Lilly & Co., has been named executive secretary of the Nat'l Wholesale Druggists' Assn.
- James C. Stowers has been appointed asst. to the president of ACF's Nuclear Energy Products div. During World War II, Stowers was awarded the Legion of Merit for his work at Oak Ridge.
- John W. Hoopes, Jr., formerly asst. prof. of chemical engineering at Columbia U., has joined Atlas Powder Co.
- Malcolm E. Hunter has been selected asst. to the president of the Nitrogen div., Allied Chemical & Dye Corp.
- Joseph W. Calby has joined the Neward office of Acheson In-





In your service Darling gate valves will offer you many times the customary number of operating cycles before repair or replacement is necessary.

It's the unique Darling fully revolving double disc parallel seat principle that does it. Get all the facts and see how you save on down-time, part replacement and maintenance.

Darling offers these gate valves in sizes, types and metals for all kinds of normal and unusual services. Write for details, specifying your service requirements.

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NAMES . . .

dustries as asst. to the technical director. Until recently, Calby had served as group leader of toxic agent piloting processes at the Army Chemical Center.

Kimon T. Karabatsos, former administrative to Rep. Miller of Nebraska, has been appointed to the staff of the Nat'l Agricultural Chemicals Assn.

R. D. Allison and A. L. Stephenson have been appointed asst. plant managers for the Woburn, Mass., and Bayshore, Calif., animal glue plants.

Edgar C. Britton, of Dow Chemical, is the 1956 recipient of the Perkin Medal of the ACS' American Section. Dr. Britton is honored for his contributions to organic chemical development.

Francis J. Sergeys has been promoted to gen'l manager of research & engineering operations at Ethyl's Baton Rouge' and Houston refineries. Paul A. McKim will succeed Sergeys as director of chem. eng. div.

Albert J. Gracia, former general manager of Goodyear Atomic Corp., has been appointed manager of research & dev. of Goodyear Tire & Rubber.

Roland S. Sawdey has been appointed manager of Hercules'
Detroit sales district of the cellulose products dept. Sawdey received his ChE degree from the Univ. of Minnesota.

Lee deForest is the recipient of the first achievement award given by the Instrument of America. Dr. deForest is widely known for his invention, 50 yrs. ago, of the first radio vacuum tube.

Russell W. Sloan has been advanced to fill the newly created position of manager of commercial development at Pennsalt.

W. D. Hill, Jr., has been named project investigator for the development dept. of Monsanto's research and engineering div. Wm. F. Amon Jr., is manager of new product development.

R. J. Fanning has been awarded the \$2,500 Dow Chemical fellowship in chemical engineering at the U. of Oklahoma. In 1946, he was also recipient of DuPont's fellowship at the U. of Missouri.



Paul L. Magill

Stanford Research Institute has granted a year's leave of absence to Paul L. Magill, air pollution expert, to allow him to serve as US technical represenative to the new Central American Institute for the Investigation of Industrial Technology.

Magill will help to establish the organization, which is designed to effect economic unity among five Central American countires—Guatamala, El Salvador, Nicaragua, Honduras, and Costa Rica—through technological development.

- A. W. Crossley has been selected executive VP of Shea Chemical Corp. Crossley, a chemical engineer, had been treasurer at Diamond Alkali.
- R. S. Douglass has been named supt of Shell Oil's refinery in Norco, La. He succeeds L. Wilson who is now manager of Shell's Montreal refinery.
- Edward O. Edney, Jr., has been appointed project manager of Westinghouse Electric's nuclear power program at the steam div. in South Philadelphia, Pa.
- Stuart O. Fiedler, a director of Kermetics Internacional, has



# MANZEL WILL FIND THE ANSWER TO ANY CHEMICAL FEEDING PROBLEM



Manzel Chemical Feeders have a wide reputation for their easy adaptability to a multitude of varied problems. But where standard models don't meet the need, Manzel engineers have repeatedly demonstrated an uncanny ability to produce special installations which do. For a soundly engineered answer to any chemical feeding problem phone, wire or write Manzel.

# It's Manzel, too, for Force Feed Lubricators

Where efficient, economical operation depends on pressure lubrication — in precise amounts — accurately timed — Manzel Force Feed Lubricators are your answer. Any number of points can be dependably lubricated under pressures as high as 30,000 psi with Manzel Lubricators.



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NAMES . . .

resumed the position of technical director of Bjorksten Research Labs.

- D. J. Stark has taken over his duties as plant manager of Escambia Bay Chemical's Pensacola, Fla., petrochemical plant.
- E. Morton has joined Esso Research Lab as a chemical engineer.



D. B. Benedict

Carbide and Carbon Chemicals Co. has appointed D. B. Benedict a vice president.

New responsibilities include planning some of the firm's long range research and development activities as well as all programs on synthetic fibers. Formerly, Benedict had been the firm's works manager.

David E. James has been appointed section head of engineering and commercial dev. at General Food's central labs; Walter H. Harte is now associate technologist in engineering research.

Sidney Cohen is now director of Hart Product's research & dev. lab.

John Maerker has been appointed director of development at Houdry Process Corp.'s research and development labs in Linwood, Pa.

Robert T. Sheen, a consulting chemical engineer, has been elected president of the Instrument Society of America.

Joseph Burbage has been named director of development for Monsanto's dev. & eng. dept., inorganic chemicals div. Wallace K. Belin is the new plant manager of the Monsanto Mexicana, S. A., plant.

Robert Cox has been promoted to supt. of production at Pennsalt's Wyandotte, Mich., works.

Carl Clausen has been appointed director of Portland Cement's mfg. process dept.

Frank Sherry has been named manager of Seiberling Rubber's plastics div. plant in Ohio.

Alex G. Oblad, manager of res. & dev. for Houdry Process Corp., has been elected chairman of the ACS's div. of petroleum chemistry.

Burton W. Schroeder has been named asst. to the president of Archer-Daniels-Midland Co.

F. W. Albaugh, former senior technical specialist at the Hanford atomic plant near Richland, Wash., has been named manager of GE's advanced engineering section, also at Hanford.

### **OBITUARIES**

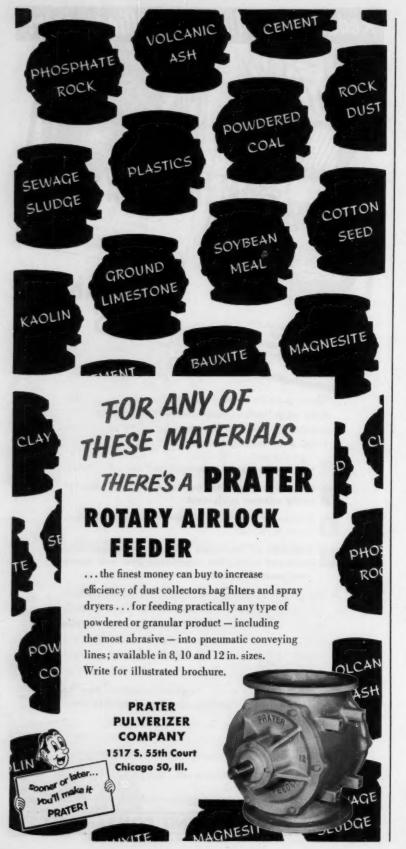
Clarence Marsh—inventor of the Marsh cell, used in the manufacture of chlorine, died Oct. 18 at the Rocky Hill, Conn., VA hospital, at the age of 83. Mr. Marsh, a retired chemical engineer, had served with Hooker Electrochemical during his early career. When Hooker evolved from "The Development & Funding Co.," he became the firm's chief engineer. Later he became a much-demanded consultant.

Lyle K. Mayne, 53, manager of American Cyanamid's Woodbridge, N. J., plant, died Oct. 7 of a heart ailment.

Aaron B. Bagsar, retired chief metallurgical engineer of Sun Oil Co., died Oct. 7 at the age of 58.

Kenneth R. Farr, VP of Petrolite Corp. and general manager of Tretolite Co., died Oct. 3 after a heart attack.





THIS MONTH'S

## **Technical**

#### BOOK REVIEWS

### Molecular Vibrations

Molecular Vibrations. By E. Bright Wilson, Jr., J. C. Decius and P. C. Cross. McGraw-Hill Book Co., New York. 399 pages. \$8.50.

Reviewed by F. C. Nachod

Experimental advances and theoretical interpretations in scientific development are never synchronized. They move ahead, like man himself, in alternating steps.

A great body of information in the fields of infrared and Raman spectroscopy has been assembled in the past ten years, in the wake of well designed and stable commercial instruments. At this point, Wilson, Decius and Cross have provided us with a "Theory of Infrared and Raman Vibrational Spectra."

In their book, they give an account of wave mechanics and of vibration and rotation of molecules. They provide the reader with a sound understanding of the mathematical apparatus without which this step ahead cannot be accomplished.

This volume would form a good background for a graduate level course. It also will be welcome to anyone who desires to know more than empirical correlation rules of infrared and Raman spectra. It's a sound book which can be recommended without reservation.

### Cost Estimation

CHEMICAL ENGINEERING COST ESTIMATION. BY R. S. Aries and R. D. Newton. McGraw-Hill Book Co., New York, 263 pages. \$6.

Reviewed by J. B. Weaver

The significant contribution of this book is an admirable compilation of estimating data from diverse sources.

This volume brings up to date an edition privately printed by the same authors in 1950. The

## Bookshelf

EDITED BY R. K. GITLIN

meat of the text is contained in some 80-odd graphs presenting, in consistent form, correlations from the literature of costs of all sorts of major process equipment and auxiliaries as a function of capacity.

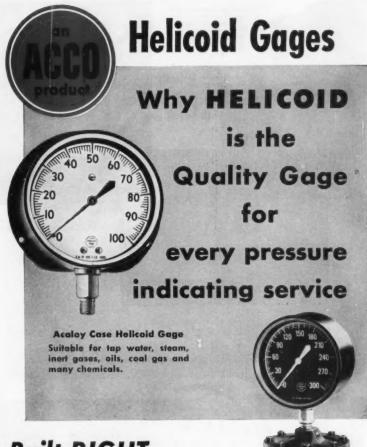
Graphs of equipment cost data are alphabetically arranged for convenience (from air conditioning units to water stills) and later graphs cover piping, insulation and utilities costs. The task of compilation from the many literature citations is a labor few of us would care to have to make and the results should be of great service.

The book follows the logical path of cost estimation, from capital investment estimates through manufacturing cost estimates, total cost estimates and measures of profitability such as return on investment. Also discussed are break-even charts and cost factors in plant location. A brief review of economic evaluation, at the end, reads like an introduction. And many readers might prefer to study it first.

Graphs and other data presented will be most helpful-with a single note of caution. The authors are compiling published data; this is 1955 and their citations run back to 1940 and 1941. All data have been converted to 1954 prices, presumably by one of the cost indices mentioned, although none is specified. One might wish that the authors had identified the curves shown as to source or date so that readers could follow their very good advice (p. 17), "too great a span of time should not be allowed to elapse in the correction of equipment prices (by indices), since technological advances may have a decided effect upon the ultimate cost.'

Graph sizes are an improvement over larger graphs in the previous edition. The new ones allow a minimum of over-precise graph readings. It is surprising, though, to see over thirty of the log-log graphs with completely unused log cycles.

Requirements of reasonable brevity always pinch a compila-



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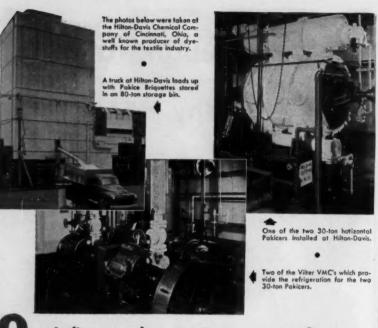


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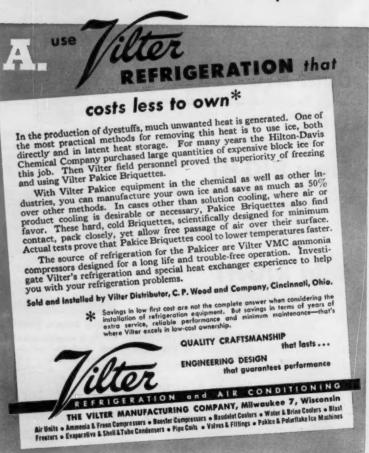
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### BOOKSHELF . . .

tion like this in some way. One of the key problems of the estimator is to realize how accurate (or inaccurate) his work should be considered. Aries and Newton caution that each of several methods of plant cost estimation, for instance, is less accurate than the earlier ones described, but no accuracy range is shown even for the most accurate. Again, the validity of Lang's factors (p. 6) is subjected to less question in this edition than in either the previous one or the original Lang article. Even in the original, the reasoning behind use of three significant figures was not clear.

There is serious question whether a chemicals price listing (occupying 38 pages) is worth the space consumption, since it doesn't seem to be any more extensive than up-to-date prices generally available.

The book's biggest weakness, for this reader, was the section on profitability and means for its determination. One statement would lead the reader to believe that the methods of profitability analysis have nothing to recommend one over another.\* Another statement implies that working capital in a profitability analysis may be equally well included or omitted.

The "Return on Investment" section discusses only one of several available methods—the one most referred to in chemical engineering cost literature, generally known as the "Engineers" or "DuPont" method and based on original investment.

Since funds invested in fixed capital are gradually returned to the investor through depreciation accruals, the original investment has not been the only denominator used in industry for return calculations. Many companies use the average book value of the fixed investment over the project's life, plus working capital. An additional

\*p. 191: "Generally, it is strictly a matter of management preferring one type to another for use in project evaluation."

t p. 192-3: "While the subsequent expressions employ fixed capital only, it is considered equally correct to apply both fixed- and working-capital requirements." method for rate of return calculations not covered by Aries and Newton is the "Investor's" or "discounted cash flow" method, which takes into account the promptness with which money is earned. Aside from any question of which method is right, modern texts covering rate of return should certainly present all three.

One of the major problems of those of us estimating costs and profitabilities has been the wide scattering of sources which must be checked for data basic to the estimating. This volume will simplify our efforts in many respects by providing a succinct compilation of such data. A second major problem we face is the temporal value of any data reported on plant and equipment costs. The book does little, if anything, to assist on this score. In fact, it may be compounding the fault by giving a 1955 citation date and 1954 cost index reference to cost data averaging perhaps five to ten years older.

#### Lab Control of Brugs

THE QUANTITATIVE ANALYSIS OF DRUGS. 2nd edition. By D. C. Garratt. Philosophical Library, New York. 685 pages. \$17.50.

Reviewed by M. E. Auerbach

This is the second edition of a book whose original title was "Drugs and Galenicals: Their Quantitative Analysis." A number of common galenicals are still included in the text.

In the main section (over 500 pages) upward of 600 medicinal substances and pharmaceutical formulations are listed alphabetically, with recommendations and details of analytical procedures for each. Some monographs are very brief, others take up several pages. The fact that the author is the chief analyst of Boots Pure Drug Co. (England) is assurance that long experience and conservative judgment have been used in determining the discussion needed for each drug. Many references to original literature are cited, the majority coming from British journals. References to American work are mostly to of-

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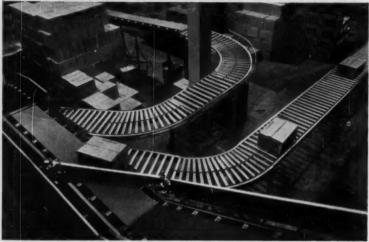


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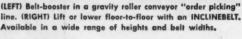
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#### BOOKSHELF . . .

ficial or semi-official compendia (U.S.P., N.F., A.O.A.C. Methods).

Some 70 pages of text present much useful information for the examination of oils, fats, waxes and essential oils. Several short appendices discussing physical methods of analysis, the Fischer assay for water and titrations in nonaqueous media, modernize this edition. Descriptions of complexometric titrations for metals are included in appropriate sections of the text.

Yet, although Garratt by no means ignores spectrophotometry and other instrumental methods (approaches so greatly emphasized in American work), the genius of this book lies in its thorough treatment of more classical methods of assay which will probably remain the core of drug analysis.

### Group IIB and Rare Earths

COMPREHENSIVE GANIC CHEMISTRY. Vol. IV. By H. M. Cyr and T. D. O'Brien. D. Van Nostrand Co., New York. 193 pages.

Reviewed by K. A. Kobe

Whereas group IB (copper, silver and gold) was allotted a whole volume in this set, group IIB (zinc, cadmium and mercury) receives part of a volume. The actual pages are about § of the volume with the remaining & devoted to the rare earths (scandium, yttrium and the lanthanide series).

Part I, dealing with zinc, cadmium and mercury, was written by Cyr. After a brief introduction comparing the three elements with one another and with neighboring groups in the periodic system, each of the three elements is discussed in a similar manner. History, occurrence, metallurgy, alloys, uses, physical and chemical properties are the main topics covered. Because of the importance of zinc oxide as a pigment, its manufacture and properties are described extensively. Other compounds of the elements are discussed briefly with emphasis on physical constants, e.g., solubility, thermodynamic functions, crystal lattice dimensions.

Part II, written by O'Brien, deals with scandium, yttrium and the lanthanides (rare earths). The term "rare earth" is hardly appropriate when it is realized that, as a group, these elements are more abundant than many of the more familiar ones such as lead, tin, zinc, arsenic, mercury, gold and platinum. Methods of separation that could produce relatively large quantities of the elements in a reasonable length of time were needed when they were found to be among the fission products of the actinide series. Ion exchange proved to be the new separation technique that has taken the rarity from the rare earths.

In group IIIB, scandium (element 21) and yttrium (element 39) are discussed in separate short chapters before the lanthanides (elements 57 to 71). The rest of group IIIB (actinides) was covered in Volume I.

A great deal of chemistry has been covered in one volume, possibly too much to do a thorough job. But the limitation of eleven volumes for the periodic system plus related topics in inorganic chemistry dictates brevity.

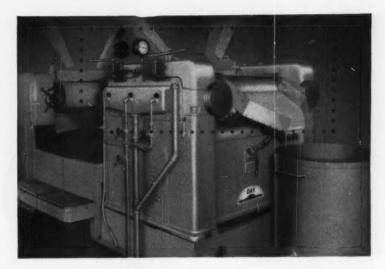
This reviewer has one suggestion: More tables and charts—and fewer photographs, e.g., zinc alloy die casting—would not only make the data presented more apparent, but would also make more concise and readable the descriptive properties of the various compounds discussed.

### X-Ray Diffraction

X-RAY DIFFRACTION BY POLYCRYSTALLINE MATERIAL. Edited by H. S. Peiser, H. P. Rooksby and A. J. C. Wilson. Institute of Physics, London. 725 pages. \$9.

Reviewed by B. Post

The literature of X-ray diffraction, concerned for the most part with the physics of the diffraction process and with single crystal analysis, has never adequately reflected the importance of the X-ray "powder" method in academic and particularly in industrial laboratories where in many cases the "powder" method is the only one used. This ex-





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cellent volume, the collaborative product of some thirty leading British crystallographers, will go a long way towards correcting this deficiency in the published literature.

Each of a wide range of topics related to the study of polycrystalline materials is dealt with in a separate essay; there are 32 in all. These include discussions of X-ray generators, monochromators and focussing cameras, counter diffractometers, low angle cameras, microbeam techniques, background scattering, preferred orientation, identification by powder photographs and many others. The essays may serve as manuals of crystallographic procedures for the beginner; the more advanced worker will find them valuable as authoritative and concise presentations of special topics.

The text layout is interesting. Early chapters deal with experimental techniques; a second section deals with the interpretation of X-ray diffraction data; results obtainable from X-ray diffraction data are discussed in the closing chapters. It's unavoidable, in a volume of this type, to have essays which vary in quality—as these clearly do. In general, however, the level of presentation is remarkably high.

Most of the essays are well written and up-to-date. All contain material not generally obtainable without a thorough literature search. Bibliographies are also notably complete and up-to-date although their usefulness would have been increased had they not been separated from the chapters to which they refer and grouped in one section at the end of the volume. There are eleven useful tables in the appendix and an excellent subject index.

Very few errors were detected in the text. One deserves comment: Thus, on p. 332, a "typical" ASTM powder diffraction data card of the newer issues is shown. It lists the pattern of alpha (low) cristobalite. The new editions of the ASTM Card Index include hundreds of cards; almost all are correct in every respect. Somehow, the one card selected for display in the text lists a gross error in the space group of low cristobalite. The

card shown is certainly not "typical."

Defects of this type are minor and do not detract seriously from the value of the book. The volume belongs on the shelves of all practicing crystallographers as well as on those of chemists, physicists and mineralogists interested in the crystalline state.

### For the Practicing Chemist

EXPERIMENTS IN ORGANIC CHEMISTRY. By Louis F. Fieser. D. C. Heath, Boston, 360 pages. \$5.25.

Reviewed by A. H. Blatt

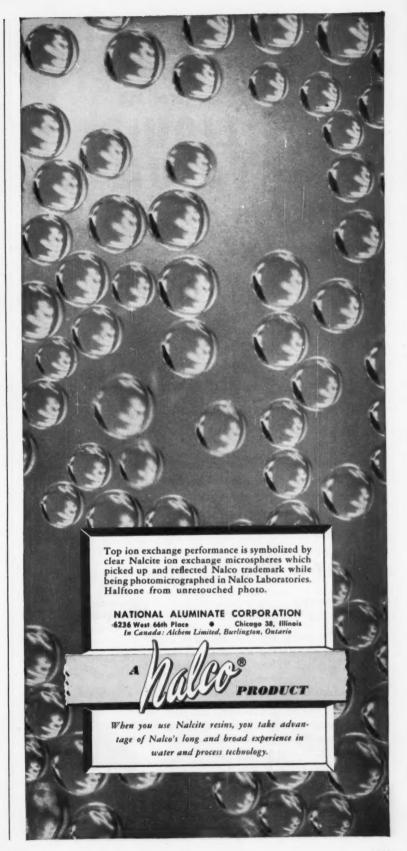
Although this book will no doubt be reviewed as a laboratory manual for course use in other, more appropriate, places, here it is being reviewed in terms of its usefulness to the practicing organic chemist.

The first part of the manual contains ten sections on techniques, including column and paper chromatography, qualitative organic analysis, cost calculations and some 28 experiments, many of which include several sequential reactions.

The second part contains sections on the use of organic literature and more advanced techniques (e.g., glass blowing), descriptions of the preparation and purification of gases and solvents and an extensive list of reagents with information about their preparation and use.

Preparations illustrate a variety of useful reactions and the discussion of these preparations will prove helpful in applying the reactions to other compounds. Comments on techniques and reagents bring together a great deal of information scattered throughout the literature. A careful reading of this manual should improve the efficiency of most working organic chemists. They should find it a useful volume to have at hand in the laboratory.

The manual is attractively set and is remarkably free from typographical errors. The two that this reader noticed (p. 62: a yield of 13.2 g. of cyclohexene from 10 g. of cyclohexanol; p. 119, line 9: number II instead of III) will undoubtedly be corrected in future printings.





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### BRIEFLY NOTED

PROFESSIONAL DEVELOPMENT-THE RESPONSIBILITY OF INDUSTRY AND THE ENGINEER. 56 pages. \$2 (NSPE members), \$4 (non-members). National Society of Professional Engineers, 1121 15th St. N. W., Washington 5, D. C. A complete transcript of the professional development conference sponsored by the National Society of Professional Engineers in Philadelphia, June 2, 1955. Among the topics covered are development and utilization of engineers in industry, industry's responsibility to its engineers, nation's needs for engineer-industry cooperation, engineer's responsibility to industry, role of engineering education in engineer-industry cooperation.

MICROBIOLOGY OF PULP AND PAPER. Monograph Series No. 15. 282 pages. \$7. Technical Associapages. St. Technical Associa-tion of the Pulp and Paper In-dustry, 155 E. 44th St., New York, N. Y. Nine authors have contributed a total of eleven chapters to this very comprehensive book on the control of microorganisms in pulpwood, mill systems and pulp and paper products. Five chapters are devoted to microbiology-one, to background information on algae and fungi; the others, to specific problems of pulpwood, fresh water, papermakers' woolen felts and spent sulfite liquor. Discussions of pulp and paper product preservation; slimes in mill systems; deterioration of coatings, sizes and adhesives; paper and paperboard in food packaging; bacterial corrosion constitute the remaining text. This monograph represents the first to assemble basic information on pulp and paper microbiology under one cover. It should prove useful both as an academic text and a practical guide.

1954 VACUUM SYMPOSIUM TRANS-ACTIONS. 147 pages. Committee on Vacuum Techniques, Box 1282, Boston 9, Mass. A compilation of papers presented at the first Symposium on Vacuum Technology, held June 18, 1954, in Asbury Park, N. J. 35 papers are divided into five categoriesnew equipment and instrumentation (9), methods and techniques for obtaining high vacuum (6), developments in fundamental vacuum technology (10), vacuum systems application and processes (9), standards and nomenclature (1). Because vacuum technique is a tool of many different fields, this book should find wide acceptance in chemistry, plastics, pharmaceuticals, metallurgy, nucleonics, electronics, etc.

AMERICAN STANDARD BUTT-WELD-ING ENDS. 10 pages. \$1. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Covers the preparation of butt-welding ends of pipe, valves, welding neck flanges and pipe fittings, but is equally applicable to other piping components which are connected into the piping system by butt-welding. Standard specifies welding lip design, outside and inside contours of castings, machining, tolerances.

#### More New Books

ANALYTICAL CHEMISTRY — The Working Tools. Vol. I and II. Edited by C. R. N. Strouts, J. H. Gilfillan, H. N. Wilson. Oxford University Press. \$16.80.

CROP PROTECTION. By G. J. Rose. Philosophical Library. \$10.

DESIGN OF HEATING AND VENTILAT-ING SYSTEMS. By F. W. Hutchinson. Industrial Press. \$7.

DRYING AND DEHYDRATION OF FOODS. By H. W. von Loesecke. Reinhold. \$7.50.

GAS TURBINES AND JET PROPUL-SION. 6th ed. By G. G. Smith. Philosophical Library. \$15.

HANDBOOK OF BARREL FINISHING. By R. F. Enyedy. Reinhold. \$7.50.

HYDROGEN PEROXIDE. By W. C. Schumb, C. N. Satterfield, R. L. Wentworth. Reinhold. \$16.50.

ORGANIC INSECTICIDES — THEIR CHEMISTRY AND MODE OF ACTION. By R. L. Metcalf. Interscience. \$8.50.

PARTICLE SIZE DETERMINATION. By R. D. Cadle. Interscience. \$5.50.

PRINCIPLES AND APPLICATIONS OF PHYSICS, By O. Bluh. Interscience. \$7.

REFLECTIONS OF A PHYSICIST. 2nd ed. By P. W. Bridgman. Philosophical Library. \$6.

PRINCIPLES OF CHEMICAL EQUI-LIBRIUM. By K. G. Denbigh. Cambridge University Press. \$7.50.

bridge University Press. \$7.50.
SAFETY IN INDUSTRY. By D. I.
Macfarlane. Philosophical Library. \$6.

SMALL-ANGLE SCATTERING OF X-RAYS. By A. Guinier and G. Fournet. Wiley. \$7.50.

SEIFEN UND WASCHMITTEL. Schweizerischen Gesellschaft fur analytische und angewandte Chemie. Verlag Hans Huber Bern, DM 12.

200 MILES UP—CONQUEST OF THE UPPER AIR, 2nd ed. By J. G. Vaeth. Ronald Press. \$5.

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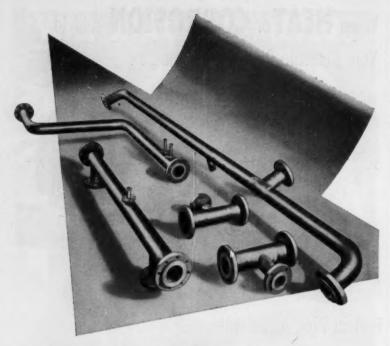
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THIS MONTH'S

## Firms in

New Locations

United States Rubber Co. has moved its Washington, D. C., office to 1700 K St., N.W.

King Engineering Corp., Ann Arbor, Mich., manufacturer of liquid level gages, flow meters and related items, has moved to 3201 South State St.

Eastman Chemical Products, Inc., has moved its Dayton sales office to 2600 Far Hills Ave., its Houston sales office to 704 Texas National Bank Bldg.

Dow Chemical Co. has relocated its Atlanta, Ga., sales office at the Fulton National Bank Bldg.

Chemical & Process Machinery Corp. has moved its headquarters to 52 9th St., Brooklyn, N. Y.

New Companies-

Fuller Paint Mfg. Co., has been formed to operate a \$300,000-2,000 gal./day plant in Manila, Philippines. The project is partially financed by W. P. Fuller and Co., San Francisco paint firm.

Bjorksten Research Laboratories for Industry, Inc., Madison, Wis., has been formed to perform industrial and all other types of non-government research. The older Bjorksten Research Laboratories, Inc., will function as a special laboratory exclusively for the performance of contracts for branches of the Armed Forces and various government agencies.

Aerosol Techniques, Inc., Bridgeport, Conn., has been established to apply aerosol techniques in filling, loading and packaging operations for the cosmetics, pharmaceuticals, industrial chemicals and chemical specialties manufacturers.

## the News

EDITED BY F. ARNE

Agile Plastic Corp. of California, Santa Ana, has been formed as an affiliate of American Agile Corp., Cleveland, to fabricate polyvinyl, chloride and polyethylene and heavy moldings of polyethylene for West Coast users.

Titanium, a new company jointly owned by four French companies, has been formed in Paris to produce titanium. Owners are: Pechiney, Electro-Metallurgique du Planet, Fabrique de Produits Chimiques de Thann et Mulhouse, and Bozel Maletra.

Mobil Overseas Oil Co. has been formed to handle most of the overseas activities of Socony Mobil Oil Co. and its affiliates in the Eastern Hemisphere and Latin America.

#### New Names

Consolidated Engineering Corp.,
Pasadena, Calif., has changed
its name to Consolidated Electrodynamics Corp. Also, a
subsidiary called Consolidated Vacuum Corp. has been
merged with the parent firm
and will be known as its ConVac division.

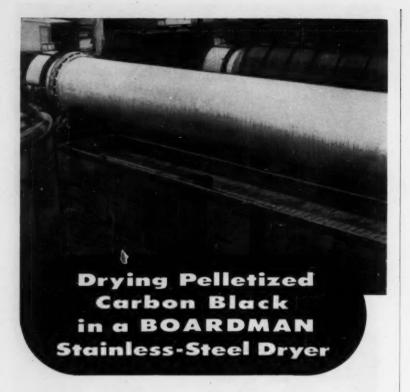
United States Gasket Co., Camden, N. J., and the Belmont Packing and Rubber Co., Philadelphia, have consolidated under the new name U. S. Gasket-Belmont Packing.

### New Lines-

Pfaudler Co., Rochester, N. Y., has contracted with the Pitmar Corp., Baltimore, to market the Titan centrifuge, a self-desludging unit for continuous removal of solids from one or two liquids, or for separation of liquids, or for concentration of solids by removal of liquid from slurries.

Oster Mfg. Co., Cleveland manufacturer of pipe and bolt threading machines, is introducing a line of hand pro-





J. M. Huber Corporation put BOARDMAN'S stainless steel experience to work on this 51-foot dryer. BOARDMAN engineers detail-designed this unit to Huber's specifications; BOARDMAN'S experienced metalcraftsmen put 45 years of "know-how" into its fabrication.

The finished equipment receives a continuous feed of moist, pelletized carbon black, which in progressing through the dryer, emerges as dry pellets —a dustless, dense, easily handled and shipped product. Your process may call for this same principle of indirect drying—or perhaps direct fired equipment meets your plans best. Regardless of the process, BOARDMAN would like the opportunity of discussing your metalcrafting problems with you.



FIRMS . . .

pelled, hand and battery operated portable lifts with capacities up to 2,000 lb.

Girdler Co., Louisville, Ky., has contracted with American Machine & Foundry Co. to be the exclusive manufacturer of the AMF continuous mixer and its continuous disc blender.

United States Steel Corp.'s National Tube Div. now manufactures polyvinyl chloride plastic pipe.

Bailey Meter Co., Cleveland, will manufacture and sell the Cities Service Heat Prover combustion analyzer for oxygen and combustibles in flue gases.

### New Representatives-

Condenser Service & Engineering Co., Hoboken, N. J., manufacturer of tubular heat exchange equipment and allied units, has selected Merrill and Co., Chicago, to represent them in the Midwest.

Arapahoe Chemicals Inc. has appointed Etablissements R. De Neve, Brussels, Belgium, as their exclusive sales representative in the Benelux countries.

Eagle-Picher Co., Cincinnati, has appointed Akron Chemical Co., Akron, as its technical and sales representative for zinc oxide to the rubber industry in Ohio, Indiana, Michigan, western New York and western Pennsylvania.

Petro-Chem Development Co., New York, has appointed Rawson & Co. of Houston and Wm. H. Mason Co. of Tulsa as its sales representatives for the southwestern states.

### New Facilities-

California Spray-Chemical Corp. has opened new laboratories in Richmond, Calif., for its bio-screening section.

Bankline Oil Co. plans for late 1956 completion of a \$2 million, 4,000 bbl./day fluid coking unit at its Bakersfield, Calif., refinery. It will convert topped crude and thermally cracked fuel oil to gasoline, gas-oil, gas and petroleum coke.

Republic Steel Corp. is doubling production of plastic pipe. Facilities are now being installed in the Cleveland plant of its pressed steel division to produce a wide range of plastic tubular products.

Garfield Chemical and Mfg. Co. is building a \$2.5 million, 250 ton/day sulfuric acid unit at its Garfield, Utah plant bringing total output to 1,000 tons daily.

Pelron Corp., Lyons, Ill., has completed manufacturing facilities for polyurethane resins and foam materials.

Borden Co. plans a 25% increase in production capacity of its chemical division plant in Illiopolis, Ill.

Cities Service Co. plans to complete a new product research center in Cranbury, N. J., by fall of 1956.

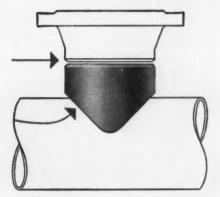
Ciba Co. will shortly open offices, laboratories and distribution facilities in Skokie, Ill.

United States Steel Corp.'s
Columbia Geneva Steel Division has completed a \$7million air cleaning and pollution control unit at sinter
and open hearth operations of
Geneva Works, Utah County,
which are said to be unique in
the steel industry.

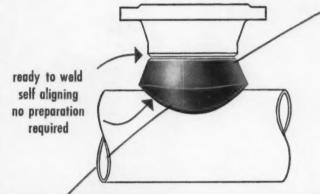
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., has formed a new engineering department to serve its chemical group of five operating divisions. Part of a program to provide specialized services for its growing chemical business, the company has also created a new chemical procurement department.

Eli Lilly and Co., Indianapolis, Ind., is undertaking a \$1.7 million fire protection promust cut must bevel

must shape must fit must bevel must align and then weld



### short nozzles DON'T PAY...



## BONNEY WELDOLETS DO!

Even on low pressure piping...avoid non-productive preparation time...

No joint preparation is required for either weld of the Weldolet, whereas considerable preparation is required for both welds of the miter branch construction.

The integral reinforcement of the Weldolet Welding Fitting has established it as an ideal method of constructing branch connections on high pressure and/or high temperature piping. This feature is bonus insurance on low pressure piping where the Weldolet is easier and more economical to use than preparing the two ends of a short unreinforced nozzle.

Sold through leading Distributors in Principal Cities



WELDING FITTINGS DIVISION

FORGE & TOOL WORKS

732 MEADOW ST., ALLENTOWN, PENNA.



## "These fairways are about as dry as the synthesis gas at the plant!"

"How dry is that, Technical Ted? Can't you ever talk anything but shop?"

"Plenty dry. Give me a cigarette."

"Still burning about that 25-foot putt I sank on the last hole?"

"Light?"

"You've got everything but the habit. Okay, I'll be your straight man—what makes our synthesis gas so dry?

"That new Pritchard Hydryer, Al. It's working like

a dream. You know, we heard it worked like a million. Now I believe it! Something like 10,000-odd SCFM, saturated at 40° F. and around 290 psia. Brings it down well below -60° F. dew points!"

"No fooling?"

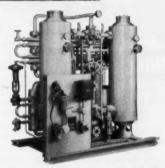
"No fooling!"

"Okay. Now that we've raved about the Hydryer, give me back my lighter and watch me sink one!"

J. F. PRITCHARD & CO. OF CALIFORNIA 4625 Roanoke Parkway, Kansas City 12, Mo.



"These fairways are about as dry as the synthesis gas at the plant!"



## EXCEPTIONAL DRYING OF GASES IS EVERYDAY ROUTINE FOR THE PRITCHARD HYDRYER!

Tried and proved by companies like E. I. duPont de Nemours and Liquid Carbonic Corp., the Pritchard HYDRYER® has exclusive features which make it ideal for drying synthesis gas, instrument air and other compressed gases:

NO WASTE. 100% of all gas entering the HYDRYER is dried without loss ... FULL LINE PRESSURE REACTIVATION. Pressuring and depressuring of adsorbers between cycles is eliminated ... PURGING ELIMINATED. The Type A HYDRYER uses inlet main gas streaming for reactivation ... LONGER ADSORBENT LIFE ... REACTIVATION GAS PRE-HEATED ... NO MOVING PARTS ... SIMPLIFIED OPERATION ... REDUCED EQUIPMENT AND LINE SIZES ... plus many other proved advantages.

### SEND FOR BULLETIN

Pritchard bulletin No. 16.0.081 tells you the many ways HYDRYERS are used in the chemical industry. Send for your complimentary copy today on your company letterhead!



J.F. Pritchard & Co.

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COOLING YOMENS & GAS A AIR VECTURE SOUTHERY
SEPRESENTATIVES IN HERICAL CITES PORC COLOR TO COLOR

. . . FIRMS

gram, involving the construction of additional fire walls and the relocation of certain facilities in antibiotic manufacturing.

Carborundum Co. has begun construction on a new plant for the manufacture of abrasive wheels near Logan, Ohio.

Carbit Paint Co. has supplemented its Chicago manufacturing operations with the acquisition of plant formerly owned by Archer-Daniels-Midland Co.

Crown Cork & Seal Co. will build a \$1.5 million research and development headquarters in Towson, Md., to work on new and improved methods for packaging foods and beverages.

Rockwell Mfg. Co. is about to complete a \$1-million warehouse, assembly and repair plant at Porterville, Calif.

Century Electric Co., St. Louis electric motor manufacturer, has opened new district offices in Birmingham, Ala., and Spokane, Wash.

Allied Chemical & Dye Corp.'s nitrogen division has opened two new sales offices for agricultural products. One is at Kalamazoo, Mich., and the other at Columbia, Mo.

General Electric Co. has opened a new analytical chemistry laboratory in Schenectady, N. Y., which consists of two conventional sections, a radiochemistry section and an instrument measurement section.

Stevens Institute of Technology, Hoboken, N. J., will begin studies of new and more economical methods of manufacturing chemical products as a result of an AEC grant which makes it possible for the institute to obtain radioactive cobalt as a source of atomic radiation.

Alaska Lumber & Pulp Co., a Japanese-owned firm proposes to build a \$55-million pulp



# Now! A Change Can Mixer with Performance Advantages of a Heavy Duty Paste Mixer!



The "Pony" Paste Mixer comes in 2 convenient types: TYPE 1 — With portable turntable (shown). TYPE2—With attached turntable.

Unique mixing action! There you have the "secret" of the "Pony" Paste Mixer. This machine combines the mixing advantages of the sigma blade, or heavy duty, paste mixer with the versatility and ease of cleaning of a change can mixer. Here is how it works:

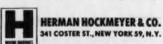
The "Pony" Mixer's 2 sets of U-shaped blades approach its two stationary breaker bars at a constantly diminishing angle, compressing the materials caught between. This creates intense shear and excellent wetting.

The staggered position of the blades permits these intense actions to be in rapid series. This reduces the load on the machine and permits the handling of heavy pastes with comparatively little

power requirements.

The wide tapered bottom blades impart an upward thrust and rolling action to the material. The can rotates in the same direction as the mixing blades at an unsynchronized rate of speed. The entire batch is constantly agitated, constantly moving; "dead" spots and stratification of materials are eliminated. This, plus the intense shear developed, guarantees superior wetting, a homogeneous batch and reduces the load in any subsequent dispersing process.

Find out how the "Pony" Mixer can help your production. For a free, illustrated folder, fill in and mail the coupon today!



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GENTLEMI trated folder in complete	EN: Please send me your free, illus- r describing the "Pony" Paste Mixer detail.
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Company_	
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## STOP THAT NOISE!

- from intake and exhaust of air, steam and other gases discharged from engines, blowers, compressors, vacuum pumps, steam or gas turbines. Burgess-Manning Snubbers are engineered to your requirements for quiet operation and greater efficiency. Available with added features for spark arresting—air cleaning—water separating—heat recovery—possures control.

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## with BURGESS-MANNING SNUBBERS



## STOP THAT PULSATION!

Drop pipe-line maintenance and service costs sharply — improve flow control and operating efficiency of your equipment by eliminating vibration caused by line surges from compressors, pumps and blowers. In new layouts eliminate cost of special and extra heavy supports to secure piping from vibration.

Write for Burgess-Manning Pulsation Snubber literature.

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723 East Park Avenue, Libertyville, Illinois Dallas, Texas

## MULTI-WASH can clean-up

Dust, fumes, vapors, soluble gases, acid gases and odors are most effectively removed.

Schneible Multi-Wash Collectors provide efficient removal of air-borne contamination and recovery of product through multiple washing action.

and recovery of product through multiple washing action.

The counterflow action allows air, gas or vapors to pass spirally upward through several stages at a velocity that impinges or condenses the contaminant against wetted surfaces, where they are flushed down and out the outlet cone in the liquid. The water or liquid enters the unit through a full-sized, non-clogging pipe opening so that heavy concentrations of slurry may be recirculated.

The intensive action of the air stream with the liquid curtains and spray patterns has

The intensive action of the air stream with the liquid curtains and spray patterns has proven very successful in the removal of soluble gases and acid gases. The liquid used varies according to type of material to be collected. Complex odors are removed by the addition of oxidizing agents in the recirculating liquid.

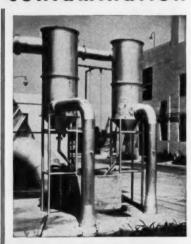
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SCHNEIBLE

FIRMS . . .

mill in the Sitka area of Alaska which will have a daily capacity of 300 tons of high-alpha cellulose pulp.

Ell-Bee Chemical Co., Hanover, N. J., with new production methods and plant, offers to formulate thinners to any specification at prices up to 20% below current market quotations.

Atlas Powder Co., Wilmington, has realigned its chemical research and development organization to consist of three groups: a chemical research department which will conduct long-range projects; a chemical engineering department which will be responsible for all commercial production studies; a product development department which will undertake market application and customer service work.

Norden-Ketay Corp. has established a western division in Gardena, Calif., with two plants for research, design and production of electromechanical devices and components for control and computing systems.

Colorado Fuel and Iron Corp. has supplemented spinning and pressing equipment at the Claymont, Del., Wickwire Spencer Steel plant with a 3,000-ton push-through press capable of producing heads up to 10 ft. in diameter.

Bourns Laboratories, Riverside, Calif., has opened a plant in Ames, Iowa, for the manufacture of miniature instruments.

University of California has established an Institute for Basic Research in Science to be supported by a \$2.75 million fund given by an anonymous donor.

West End Chemical Co. has acquired an exceptionally pure lime rock deposit in the Argus Range just north of their present plant location in Westend, Calif. Under consideration is the installation at the site of a 170-ton rotary





AE DF

## Removable-Header WATER COILS

- Complete Drainability
- Easily Cleaned
- High Heat Transfer

Completely drainable and easily cleaned, Aerofin Type "R" coils are specially designed for installations where frequent mechanical cleaning of the inside of the tubes is required.

The use of 5/8" O.D. tubes permits the coil to drain completely through the water and drain connections and, in installations where sediment is a problem, the coil can be pitched in either direction. The simple removal of a single gasketed plate at each end of the coil exposes every tube, and makes thorough cleaning possible from either end.

The finned tubes are staggered in the direction of air flow, resulting in maximum heat transfer. Casings are standardized for easy installation.

Write for Bulletin No. R-50

## AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N.Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

#### FIRMS . . .

lime kiln using natural gas as fuel. Carbon dioxide from the operation would be used in the carbonation process, eliminating the vertical lime kiln operation.

American Colloid Co., Chicago, plans to construct a \$500,000 barite mining and processing plant near Dierks, Ark.

Pfaudler Co., Rochester, N. Y., has established an applications engineering section.

Kelite Corp., Los Angeles manufacturer of industrial cleaning and processing chemicals and equipment, has acquired a Hawaii factory branch through a merger with Chemtox Co., Ltd., a Hawaiian chemical firm.

Titanium Metals Corp. of America has established a Cleveland district sales office.

National Starch Products Inc. is doubling the vinyl acetate resin capacity of its new Meredosia, Ill., plant.

Connecticut Chemical Research Corp., Bridgeport, Conn., contract producer of aerosols, plans new manufacturing facilities on the West Coast and expansion of its Canadian affiliate in Toronto.

Abbott Laboratories, North Chicago, Ill., has opened a new sales headquarters and distribution center in Kansas City, Mo., to serve the Southwest.

Jones & Laughlin Steel Corp.'s container division has completed a new plant in Port Arthur, Tex., for steel drums to serve the oil and chemical industries of Texas.

Diamond Black Leaf Co., Cleveland, has acquired the Des Moines, Iowa, pesticide processing plant formerly owned by Geigy Chemical Corp., New York.

Petrochemical Industries Ltd. is building a 588,000 lb./yr. plant in Edmonton, Alta., to use polyethylene raw material

### TURBO COMPRESSOR FOR OXYGEN PLANT



Turbo Compressor for Oxygen Plant

HE extensive fabrication program of our Mechanical Engineering Division comprises among others

COMPRESSORS **BLOWERS** GAS CIRCULATORS COLUMNS

HEAT **EXCHANGERS** PRESSURE VESSELS STORAGE TANKS



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pumps, in a two stage in-stallation, are ably handling 600 GPM of fly ash slurry against 400 ft. of head, at Windsor plant of Beech

Bottom Power Co., Power, W. Va. Water-end parts are of abrasion resistant ABK Ni-Hard nickel iron alloy.

Design of the Nagle type "T" pump provides quick slippage seal adjustment, accessibility of stuffing box and split bearing stand. Entire pump can be quickly dismantled, but it's seldom necessary because it's a Nagle Pump—built for gritty, abusive jobs—pumping abrasive and corrosive materials or hot liquids. liquids.



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NAGLE PUMPS, INC. 1235 CENTER AVE., CHICAGO HEIGHTS, ILL.





FOR

ABRASIVE

AND

CORROSIVE

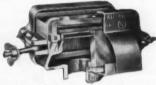
APPLICATIONS

PROTECTOSEAL FLAME ARRESTERS AT OPEN VENTS PROTECT HIGH FLASH POINT SOLVENTS

### STORAGE TANK INSTALLATION AT EASTERN BY-PRODUCT BENZOL **PLANT COMBINES**

Maximum Air-Flow Capacities Positive Fire Protection Low-Cost Maintenance

Protectoseal Series No. 860 Non-Conserva-tion Type Vents installed on the large, hori-zontal storage tanks of this By-Product Benzi-Plant provide maximum air-flow consistent with operating efficiency, positive fire protection and affective law-cost maintenance.



LIGHT WEIGHT, PRESSURE-TIGHT HOUSINGS Combine ease of installation with durability. Housings meet hydrostatic pressure tests by Underwriters' Laboratories.

### POSITIVE FIRE PROTECTION

Sturdy Protectoseal rectangular plate type flame arrester protects tank contents by preventing the propagation of fire and explosion into tank. Easily accessible for cleaning without disturbing original factors alignment. original factory alignment.

### LOW-COST MAINTENANCE

Modern swing-bolt design permits quick removal of vent covers and weatherhoods for visual inspection or cleaning.

VAPOR CONSERVATION TYPE VENTS



Similar in design to the Non-Conservation Vents but in-corporate relief valves in the vent housing which con-serve vapors to reduce costly evaporation losses. Valves retard intake of air and escape of vapors as tank normally breathes in and out.



An exclusive Protectoseal An exclusive Protectoseal design approved for in-stallation at varying dis-tances from open end of vent pipe. Suitable for inside tank house in-stallations on storage or processing tanks, bleed lines, bleed tanks or other waste gas lines.

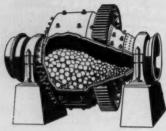
PROTECTOSEAL MANUFACTURES ALL TYPES OF FLAMMABLE LIQUID STORAGE TANK VENTING AND OPERATING COUPMENT: NON CONSERVATION TYPE VENTS • FLAME ARRESTER RODDING OPENING UNITS • VAPOR CONSERVATION TYPE VENTS • STEAM TRACED VENTING EQUIPMENT • FLAME ARRESTER FILL OPENING UNITS • LOADING AND UNLOADING DEVICES

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INDIRECT-FIRED ROTARY DRYERS AND HEATERS

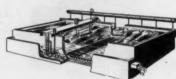
TRICONE MILLS



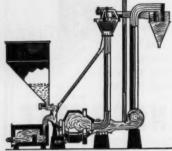
STEAM TUBED ROTARY DRYERS



THICKENERS-CLARIFIERS



AUTOMATIC BACKWASH SAND FILTERS



AIR CLASSIFYING SYSTEMS



ROTARY AND SHAFT KILNS



TUBE MILLS



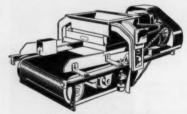
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CONICAL SCRUBBERS



ROTARY COOLERS



CONSTANT-WEIGHT FEEDERS

Write for general catalog 100-A-11 which describes the entire Hardinge line.

## HARDINGE COMPANY, INCORPORATED

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#### FIRMS . . .

to manufacture piping, tubing, sheeting and packaging film.

Sinclair Research Laboratories will build a radiation facility at its Harvey, Ill., research laboratories to carry out its long-range program of evaluating the effect of atomic fission product radiation in such large-scale petroleum processes as cracking, hydrocracking and isomerization.

Missouri Portland Cement Co. is expanding its North St. Louis plant by about 11% to 5 million bbl./yr.

Carborundum Co. plans to spend \$1.5 million in the next 5 yrs. to expand its fused cast refractories plant at Falconer, N. Y.

Vanadium Corp. of America plans a new plant in Jefferson County, Ohio, for the production of ferroalloys. Initial operation is scheduled for late 1956.

Imperial Oil Co. has started up a \$14 million plant at Edmonton, Alta., to make 41 types of lubricating oils from crude oil. It is the first plant to use hydrogenation on full scale in finishing lubricating oils.

Container Corp. of America will build a \$27 million pulp and paper mill at Brewton, Ala., with initial capacity of 100,-000 tons/yr.

Vitro Corp. of America has begun a 70% expansion in capacity of its Salt Lake City uranium mill. Additional ore to be processed comes to 5,000 to 9,000 tons/mo. Vitro has also just acquired the Refinery Engineering Co., Tulsa, Okla., which constructs petroleum byproduct chemical plants in addition to oil refineries.

American Potash and Chemical Corp. has acquired Western Electrochemical Co. which it will operate as a subsidiary.

Colonial Uranium Co. has acquired Thorium Corp. of



### "TOPS" by EVERY TEST

Capacities 150 G.P.M.







APCO Two Stage Pump or High Pressure Service

APCO is the highest development of the Turbine-Type Pump. Unsurpassed for small capacity high head duties. Handles. non-lubricating liquids almost indefinitely without wear. Suited to "1001" duties. Write for Bulletin III or Condensed Catalog "M".



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## HIGH **PRESSURE** VESSELS

 Whether you want conventional highpressure units or something special-send us your inquiries. COLE can build you the kind of high-pressure tanks or vessels you require—any size, any shape, any metal. Our experience of a century (we were established in 1854) in the design and fabrication of metal tanks may be of help to you.

Send us your inquiries for tanks of all kinds. Write for Catalog-Tank Talk.

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### McGraw-Hill Mailing Lists Will Help You

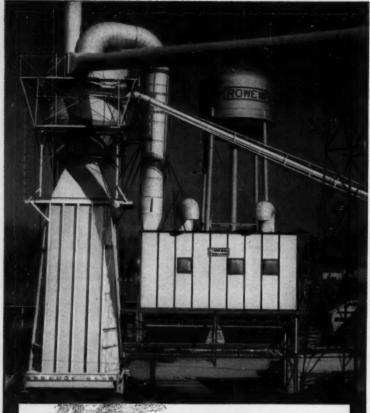
- Merchandise your advertising

Merchandise your advert
 Conduct surveys
 Get inquiries and leads
 for your salesmen
 Pin-point geographical
 er functional groups
 Sell direct
 Build up weak territories
 Aid dealer relations

Direct Mail is a necessary supplement to a well rounded Business Paper advertising program.

Most progressive companies allocate a portion of their ad budgets to this second medium at the same time as they concen-trate on the best business publications. 600,000 of the top buying influences in the fields covered by the McGraw-Hill publications make up our 150 mailing lists. Pick YOUR prospects out of our ladustriol Direct Mail catalogue.

Write for your free copy of our Industrial Direct Mail catalogue. With complete information.



Dust makes it "hot" for Rowe!

Pangborn Dust Control saves Rowe over \$12,000 a year in heating costs

Dust used to "make it hot" for Rowe Manufacturing Co., Galesburg, Ill., by posing a serious problem. Rowe, a large producer of wood products (like the Ro-Way garage door), was troubled by the great volume of dust created by its many woodworking operations. Today dust makes it hot for Rowe in a different way! Thanks to Pangborn Dust Control, collected dust now fuels the boilers that provide steam for power and heat. The dust collected by Pangborn Dust Control saves

Rowe over \$12,000 in heating costs annually! In addition, Pangborn has improved community relations, employee relations and plant

Pangborn can solve your dust problem. Pangborn engineers will be glad to show you how Pangborn Dry or Wet Dust Collectors can save you time, trouble and money!

See how Pangborn benefits varied industries. Write for free copy of "Out of the Realm of Dust." Pangborn Corp., 2600 Pangborn Blvd., Hagerstown, Md. Mawnjacturers of Dust Control and Blass Cleaming Engineers.

Pangborn CONTROLS DUST

FIRMS . . .

America and as a result will construct milling facilities for thorium ores in Colorado, Wyoming and New Mexico.

American Gilsonite Co. is building a \$5 million processing plant near Grand Junction, Colo., to produce coke and high-test gasoline from gilsonite mineral.

Pennsylvania Salt Mfg. Co. is about to start up a plant in Paulsboro, N. J., for the production of new, granular type commercial fertilizers.

Chas. Pfizer & Co. plans to build a Pacific Northwest distribution warehouse in Portland, Ore.

Pennsylvania Industrial Chemical Corp., Clairton, Pa., manufacturer of synthetic resins and solvents, has opened a West Coast district office in Los Angeles.

Delta Chemical Co., Memphis, Tenn., manufacturer of industrial and automotive cleaning compounds is building a \$108,000 plant and warehouse.

Procter & Gamble has consolidated all functions of its subsidiary companies, the Buckeye Cotton Oil Co. and the Buckeye Cellulose Corp. into one corporate unit to be called the Buckeye Cellulose Corp.

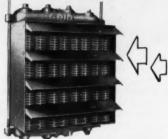
Stauffer Chemical Co., New York, has started construction of a \$250,000 chemical laboratory at its Chaucey, N. Y., research center.

Burgess-Manning Co., Libertyville, Ill., has opened a New York City sales office.

John Zink Burner Co., Tulsa, Okla., has built an experimental furnace designed to permit testing at heat releases from 500,000 to 20 million btu/hr. for use, without charge, of the process industries.

Chemical Producers Service, Inc., has bought a plant at Port Reading, N. J., from Petroleum Solvents Corp. The





### **UNIT HEATERS**

Trouble-free heating service in

### Major Chemical Plants

Because of their cast iron construction heating sections, GRID Unit Heaters stand up against corrosive fumes of HCI, CI2, etc., one of the real reasons for the wide acceptance of GRID Unit Heaters throughout the chemical industry. This reason plus these other features of construction—

GRID'S All-Cast construction having similar metals in contact with steam prevents electrolytic corrosion.

GRID'S ability to withstand steam pressures up to 250# P.S.I.

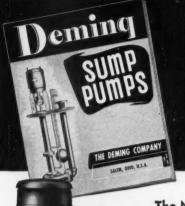
GRID'S low outlet temperatures, proper fan sizes and motor speeds assure delivery of warm, comfortable air in ample valume, directly to the spot where it is needed. Maintenance cost conscious management men turn to GRID for relief from the continuous expense of heating failures experienced with ordinary unit hacters. GRID Unit Heaters installed in 1929 are still operating today . . . the only attention needed has been an occasional ailing of the motor. No ordinary unit heater can approach this record.

WRITE for complete catalog . . . also ask are ideal for use throughout many chemical processing industries. (Catalog BC-1049)

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The New Deming Bulletin 4500 can help you to select the most efficient unit for a specific sump pump job. Contents of the 8-page bulletin include illustrated construction features of Deming Sump Pumps, information on Single and Duplex types, Size and Horsepower Recommendations for Various Ratings, Standard Dimensions of Units, information on Control Equipment, Specifications and other useful data.

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Please send free copy of your Sump Pump Bulletin No. 4500.

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Please check here if you want the names and addresses of Deming Distributors in your area.



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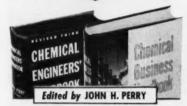
THE YOUNGSTOWN WELDING & ENGINEERING CO.
3712 OAKWOOD AVE. YOUNGSTOWN 9, OHIO

FIRMS . . .

plant will serve as liquid chemical storage terminal with facilities for private label packaging, drumming, canning, blending, laboratory research and formula development.

- E. I. du Pont de Nemours and Co. has opened a \$1 million sales development and technical service laboratory for its film department at Chestnut Run near Wilmington.
- Holmes & Narver, Inc., Los Angeles, has formed a petrochemical division which will design, engineer and construct plant facilities, systems and other equipment in the petroleum, chemical and processing fields.
- North American Aviation, Inc., Los Angeles, has established Atomics International as a separate division to handle all of the company's nuclear engineering and manufacturing operations.
- Texas Instruments Inc., Dallas, has established an eastern region marketing office in New York.
- C. H. Wheeler Mfg. Co., Philadelphia, has formed an atomic energy division to provide engineering, design, development and manufacturing facilities for steam condensers and auxiliaries, heat exchangers, pumps and valves for atomic power generation.
- Shawinigan Chemicals Ltd. is building a \$750,000, 25,000 tons/yr. sulfuric acid plant at Shawinigan Falls.
- Montana Sulphur and Chemical Co. has about completed construction of a sulfur manufacturing plant in Billings, Mont.
- Canadian Industries Ltd. plans completion of a 200 ton/day synthetic ammonia plant at Millhaven, Ont., by mid 1956.
- Canadian Gulf Oil Co. plans fall completion of a 225 ton/day sulfur plant near Lethbridge, Alta

## The FACT you want CHEMICAL ENGINEERING BUSINESS is here!



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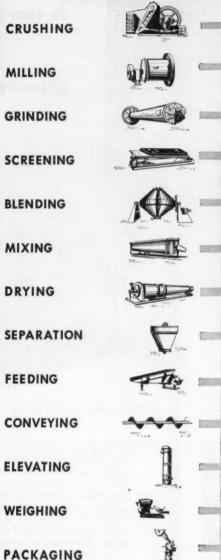
You'll be able to check your methods against approved practice — get quick answers to your everyday problems with these two books, because they were prepared by the top men in the field. You'll find help on everything from heat transmission to industrial advertising, from high-pressure technique to control by cost accounting. Whether you're a practicing engineer, executive, plant or laboratory worker, or mechanical engineer in a process industry, these books can help you—give you answers to a vast range of problems on the engineering and business aspects of the chemical industries.

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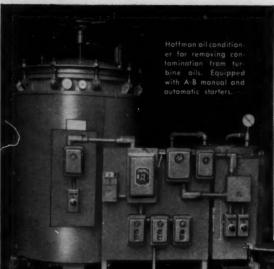


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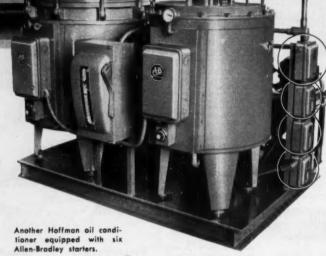
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The many advantages of Enjay Butyl make it the almost perfect rubber for the automotive industry. Its price and ready availability are advantages, too. And it is now available in non-staining grades for white and light-colored parts. For full information and for skilled technical assistance in the uses of Enjay Butyl, contact the Enjay Company at either of the addresses below.



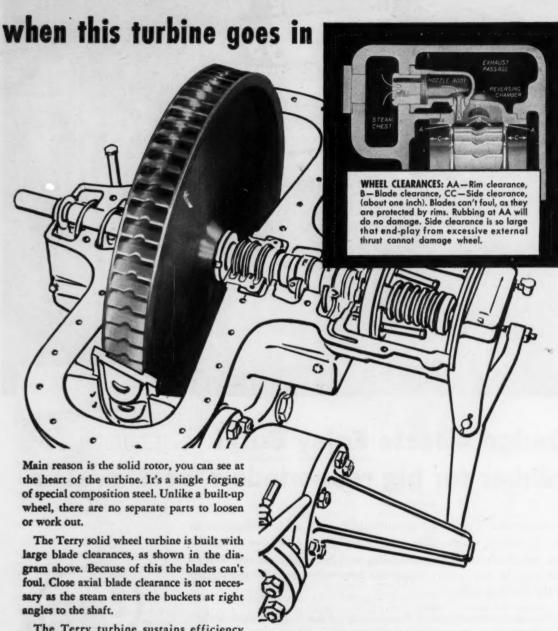
ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y. District Office: 11 South Portage Path, Akron 3, Ohio.



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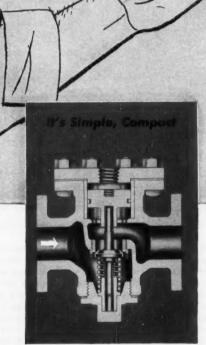
The Terry turbine sustains efficiency through the years. Reason: The power producing action of the steam takes place on the curved surfaces at the back of the buckets, so blade wear which might occur is of little consequence.

Bulletin S-116 tells more about these "Work Horses of Industry." Send for a copy today.

THE TERRY STEAM TURBINE COMPANY TERRY SQUARE, HARTFORD 1, CONN.



## This operating valve is always within reach



Simplicity and compactness keep cost down, reliability up in this Leslie Class LP operating valve.

Make a demand — the valve obeys. It's like having a third hand and a long arm as the control for this shutoff valve is always within reach.

You can get Leslie shut-off valves equipped with an electric solenoid valve (Class LG) or you can operate them remotely (LP) with air or hydraulic relay valve. Valve opens and closes on demand of a manual or automatic signalling device (pressure switch, thermostat, etc.) Designed for off-on service, there are units with body ratings to 1,000 psi and temperatures to 750°F. The valves give fast, tight shutoff of steam, air and noncorrosive fluids.

Ask your Leslie engineer to help you select the operating valve that's engineered to meet your service requirements. You'll find him listed under "Valves" or "Regulators" in your classified telephone directory.

Bulletin 5309 describes operating valves.

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CLASS LG WITH SOLENOID

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CONTROLLED QUALITY MEANS QUALITY CONTROLS

CHEMICAL ENGINEERING-January 1956



Now, for the first time one manufacturer is able to offer a completely integrated, "packaged" fluid agitator service. No other manufacturer controls, within its own organization, such extensive and specialized designing, engineering, manufacturing, assembling, testing, and field servicing facilities devoted exclusively to fluid agitator production. Philadelphia Gear Works manufactures impellers, shafts, drive supports, all gears, and reducer housings. Only Phillie Gear can offer you the complete solution of your fluid agitator problems—through one centrally-controlled, thoroughly responsible source.

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Philadelphia Gear Works products have "measured up" through 63 years of industrial leadership. Compare the new Philadelphia Fluid Agitators for economy, efficiency and quality. See for yourself why Philadelphia Fluid Agitators are your very best investment.

COMPARE THESE FEATURES: Exclusive Philadelphia Low Head Room Design—maximum bearing span with minimum headroom • Helical Change Gear Set, within housing, allows for ready selection of up to 14 different standard speeds • Heavy Duty Thrust Bearings permit use of standard units for conditions of high pressure in closed tanks • Large Heavy Duty Output Shafting results in less shaft deflection at stuffing box or mechanical seal, steady operation of long overhung agitator shafts • Philadelphia Heavy Duty Inboard Bearing Support provides extra rigidity resulting in superior gear

performance and life ⊕ Spiral Bevel Gears of Hardened Steel, accurately lapped for long and quiet operation ⊕ Field-proven Philadelphia Dry-Well Construction prevents oil leakage down output shaft ⊕ Labyrinth-type seal on input shaft allows effective sealing with minimum friction ⊕ Askfor Bulletin A2-55.



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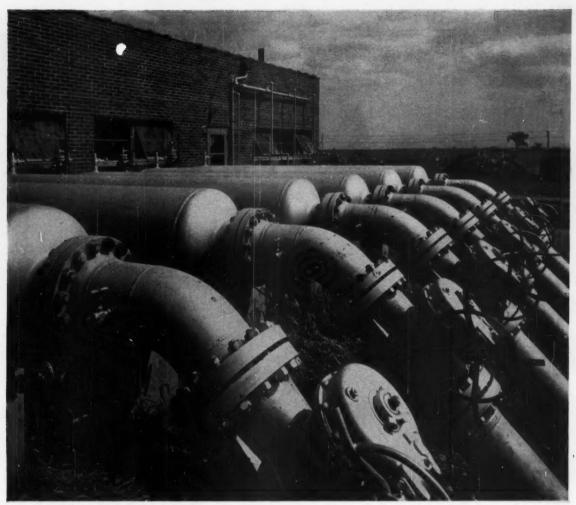
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Industrial Gears & Speed Reducers

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Natural gas — 400 million cubic feet a day — pours into the Petro Extraction Plant from the Panhandle Eastern Tuscola compressor

station. After removal of hydrocarbons, the gas is returned to Panhandle Eastern lines for transmission as fuel gas.

## Petrochemicals...

### from pipeline gases

At the Petro plant—Tuscola, Illinois—an endless stream of natural gas is being separated into ethane, propane, butane and natural gasoline.

### products you need

The ethane is converted into ethylene, which is in turn converted to ethyl chloride, ethyl alcohol, ether and polyethylene. U.S.I. ammonia and sulfuric acid plants next door supply and receive raw materials.

### for the future

Petro can manufacture products other than these if the demand arises—products that can be made from the many raw materials available at the plant site.

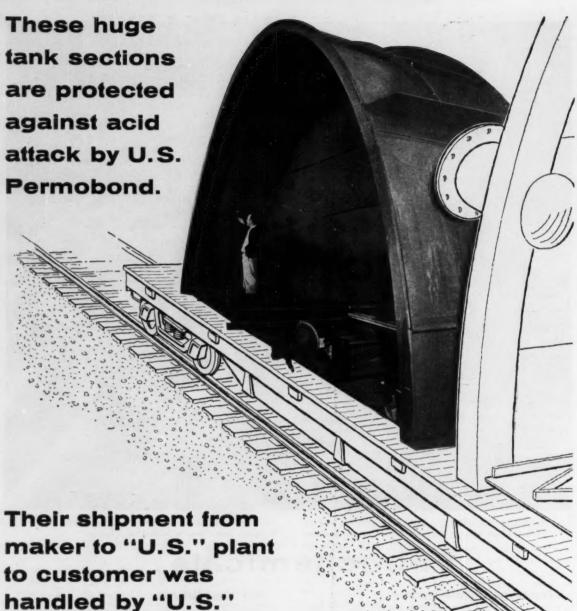
### in bulk quantity

Why not add this plant to your facilities? Our engineers will be glad to discuss your long-term bulk requirements for chemicals from National Petrochemicals Corporation.

## NATIONAL PETRO-CHEMICALS

CORPORATION

A joint enterprise of National Distillers Products Corporation and Panhandle Eastern Pipeline Company
99 PARK AVENUE, NEW YORK 16, N. Y.



The expansion plans of a Southern chemical plant called for the design of a processing tank that was so huge it could not be shipped in one piece.

So the steel fabricator's engineers, working with "U.S." engineers, designed the tank in 2 parts. The tricky task of transporting these immense sections from the fabricator to the "U.S." plant (where U.S. Permobond protective linings were installed) and from there to the chemical plant was arranged by "U.S." traffic

specialists. When the 2 sections arrived at the chemical plant, "U. S." field service men vulcanized the joints after the halves were welded together, making a complete rubber lining with no seams or joints. Thanks to the Permobond® lining, the tank is immune to acid attack.

For protection against corrosion of tanks, piping, valves—get in touch with U.S. Rubber technicians at Rockefeller Center, New York 20, N. Y.

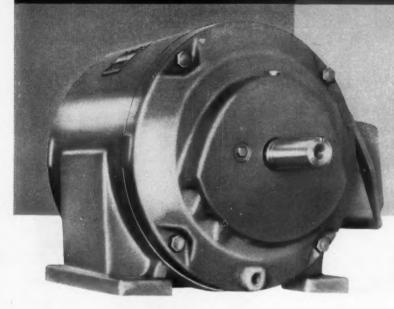


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The total protection concept of design and construction armors Reliance A-c. motors against everyday hazards, with little or no maintenance. Total protection is made up of extra features like:

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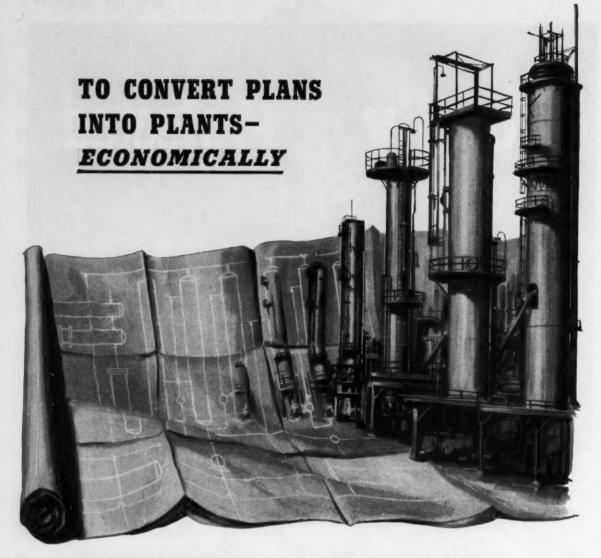
Metering plate regulates grease flow to bearing from reservoir

Ventilation louvres positioned high and dry in end brackets

There are 100 of these extra core to cover protection features in Reliance Motors. Each point is covered in our bulletin, Check the 100 Facts. Why don't you write for one, and get all the details?

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- Deal with an organization which knows that processing time lost can be counted as dollars wasted.
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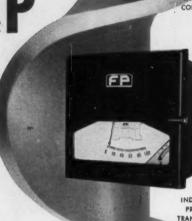


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Fifth BROS Packaged Boiler ... goes from flatcar to foundation in 6 Hours

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... These units operated in series, provide a total steam capacity of 150,-000 lbs. per hr. Each unit's design pressure is 600 lbs.

### HERE'S REAL OPERATING ECONOMY

Because of the flexibility of packaged boilers operating in multiples, you exercise close control over steam requirements, keeping fuel costs down. Also, varying load conditions are easily accommodated. So there's real satisfaction to Foster Grant in having maximum operating efficiency, regardless of load conditions.

Design features, fast installation and operating economy make the Bros Packaged Boiler the logical choice in your expansion plans. Capacities range from 4,100 to 30,000 lbs. of steam per hour. Gas or oil fired or combination. Choice of manual, semi or fully automatic controls. Expertly designed boilers by boiler experts since 1882.

Write today for the factful Bros Packaged Boiler Catalog WT-7; no obligation, of course.

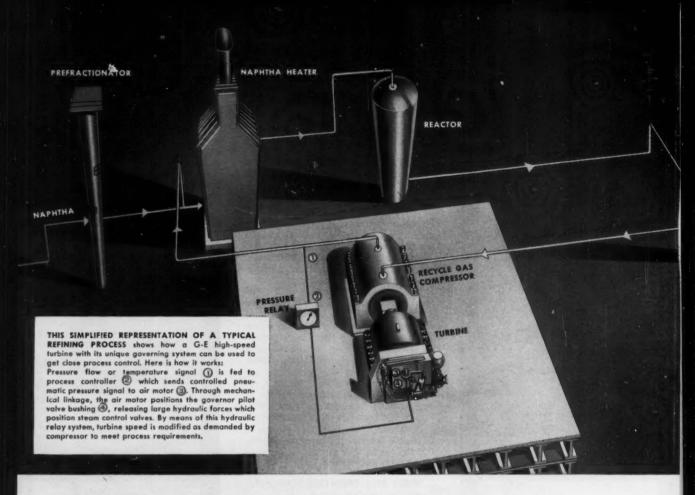


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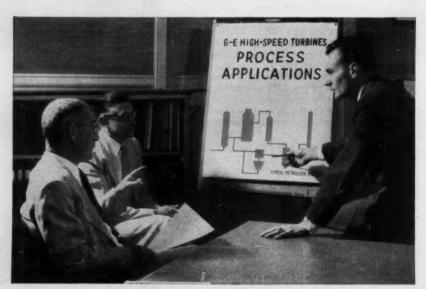
DESIGNERS AND MANUFACTURERS OF WATER-TUBE BOILERS, 2, 3, and 4 DRUM AND PACKAGED DESIGNS. AUXILIARY EQUIPMENT AND FULL LINE OF INDUSTRIAL STOKERS

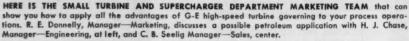




EASILY INCORPORATED INTO YOUR PRESENT SYSTEM . . .

# G-E position-restored turbine governing





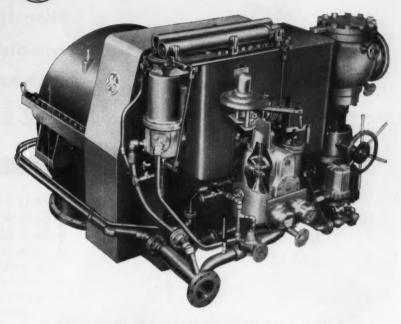


# FOR ALL PROCESS APPLICATIONS

- PETROLEUM
- CHEMICAL
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- STEEL







THE GENERAL ELECTRIC POSITION-RESTORED GOVERNOR, shown cutaway above, utilizes the best features of both mechanical and hydraulic control. Heart of the system is a fly-ball-positioned, rotating pilot valve, which releases a tremendous store of power to position the steam inlet valves. The released power is controlled through feedback by a weight-biased mechanical-linkage that repositions the pilot-valve bushing only in direct response to movement of the steam-inlet valves, rather than in response to a force generated by the movement of the valves.

# can give you close process control

In process industries, if quality-control and peak production are to be maintained, turbines that drive high-speed compressors and blowers must have close, accurate governing in response to load requirement and the slightest variations in steam conditions.

To help you get more precise control, all G-E high-speed turbines have a position-restored governor. It is an oil-relayed, mechanical-type control device that automatically matches turbine speed to process demands.

This governor will operate accurately and effectively with any recycle controlling system because the mechanical-linkage can be adjusted to match the complete output-signal range of any process controller. The G-E governor can be incorporated with a typical control system as shown in the schematic drawing.

FOR CLOSE PROCESS CONTROL the unique design of the G-E high-speed turbine governor offers these advantages:

Accurate signal relay results since speed changes are made through a weight-biased mechanical-linkage which repositions the pilot valve bushing only in direct response to movement of the steam-inlet valve. The system is not affected by oil-flow forces and is quick to respond to changes in process requirements.

**Direct, precise speed settings** are therefore possible because turbine response to process requirements is not dependent on force balance between springs and signal pressure.

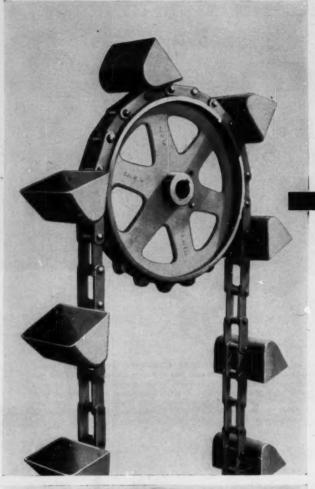
Completely integrated governing responds not only to process demand but also to steam pressure or temperature changes, which must be factored in for close process control.

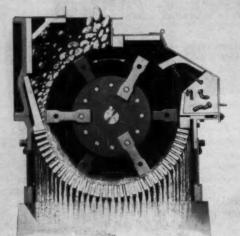
Position-restored governing keeps the system in near-perfect equilibrium, practically eliminating speed surges and turbine "hunting." Be sure to see how this governing system may be used to advantage in your process operation.

For more detailed information, contact your nearest General Electric Apparatus Sales Office or write General Electric Company, Schenectady 5, N. Y. In Canada, contact Canadian General Electric Company, Limited, Toronto.

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Type A Jeffrey Pulverizer

# Handle it mechanically with JEFFREY machinery and save

### JEFFREY CHAIN, SPROCKETS AND BUCKETS

JEFFREY Combination Chain is recommended for drives of moderate speed and for conveying gritty materials. Besides having excellent wearing qualities, it is able to withstand shocks, making it the logical choice for this severe service.

Chainsaver Sprockets, a Jeffrey Development, add to the life of chains in elevating and conveying service. The chain rides on the flanges as well as seating in the usual position, thus distributing the wear.

Jeffrey malleable iron buckets are smooth, seamless and strong, affording comparatively clean delivery of the material. They are highly resistant to the corroding effect of acids, greatly lengthening their life.

### JEFFREY PULVERIZERS

These pulverizers are well suited to reducing the various classes of materials met with in the Fertilizer, Rendering and similar industries. They strike the material while it is in suspension and the degree of fineness is determined by the intensity of the hammer blows and the size of the opening between the screen bars. A large variety of meshes can be obtained simply by varying these two factors.

For help on materials handling problems, write to The Jeffrey Manufacturing Company, Columbus 16, Ohio.



SIZE (but at no extra co

# MIDWEST "LONG TANGENT" **ELBOWS**

Among all standard welding elbows, only Midwest "Long Tangent" Elbows can be described as "King Size" . . . only they have the long straight ends which equal 1/4 of the nominal fitting diameter (a 12" Midwest "Long Tangent" Elbow has tangents 3" long). This greater length is responsible for significant savings on many piping systems (see advantages listed below). For additional information, ask your Midwest distributor or write us for Catalog 54.

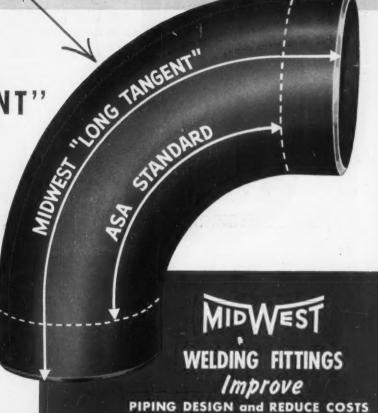
### MIDWEST PIPING COMPANY, INC.

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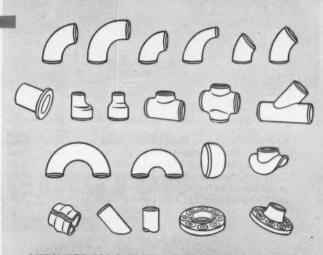
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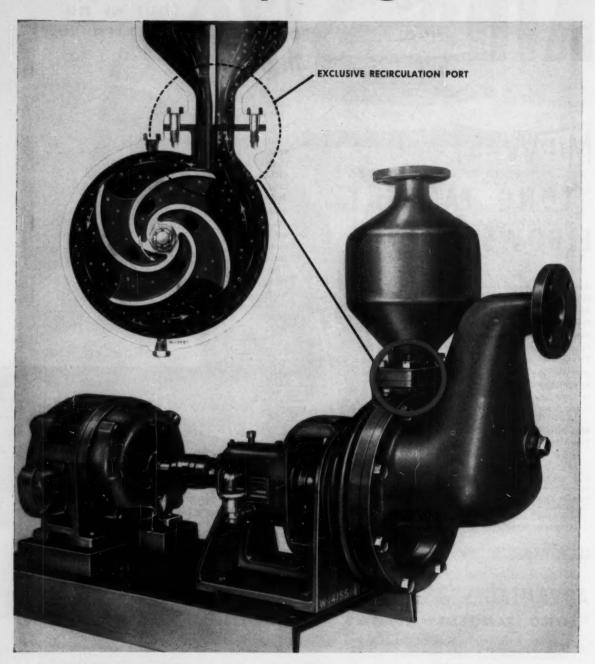
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As shown in cutaway, impeller mixes liquid trapped in suction chamber with vapor or air from suction and forces mixture into recirculation chamber. Vapor leaves by discharge pipe, while vapor-free liquid falls back through recirculation port (red) for remixture with vapor. Process continues until pump is primed. Easy replacement of recirculation port permits use of variety of impeller sizes and maintenance of critical clearance between impeller and port.

<sup>\*</sup> Worthington's super-stainless corrosion resisting alloy steel.

# centrifugal chemical pump

# Features wider coverage in capacity and head than any similar pump in the chemical industry

Three pump sizes, plus exclusive Worthington removable RECIRCULATION PORT, plus a variety of different impeller diameters for each pump, make this new pump the most versatile self-priming corrosion resistant pump available.

It's the Worthington type CNGK. Part of the Worthington SESC line, this new pump is recommended for chemical sump pumping, tank-car unloading, or any application where both liquid and vapor handling capacity is required.

Key to the CNGK's flexibility (see photo at left) is the exclusive new Worthington removable recirculation port. Here's what the removable recirculation port gives you:

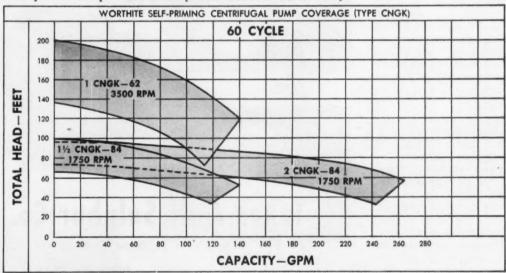
- 1. Wider coverage without the use of belt drive. In each pump size, impeller diameter can be cut down with very little change in priming time. Various combinations of impeller diameters, and recirculation port lengths are available for each pump. This means that the close clearance required between impeller and recirculation port can be maintained regardless of impeller diameter.
- 2. Renewable clearance at tongue. Removable recirculation port allows replacement of this part in those

services where severe wear may be encountered. This feature enables the pump user to renew a critical clearance with a small repair part.

- 3. Smaller, lighter pump with faster prime. The recirculation port is designed for maximum recirculation velocity. This cuts down the volume of liquid required to transfer a given amount of air or vapor from the suction to the discharge pipe and allows smaller volume for suction and discharge chambers than in other designs.
- 4. Versatility is further carried out since these pumps are designed for both packed stuffing box or mechanical seal operation. Worthington's type EA mechanical seal, proven over many years of operation in the Chemical Industry, is available on the type CNGK pumps. The pump and mechanical seal are an integrated design, and all parts of the mechanical seal are as corrosion-resistant as the pump itself.

Remember – the CNGK is part of the standard SESC pump line. Minimum use of special parts means lower initial costs and easier, faster servicing.

For complete data on this latest Worthington standard chemical pump, write today for bulletin W-350-B-13. Worthington Corporation, Section PC.5.39, Harrison, New Jersey.

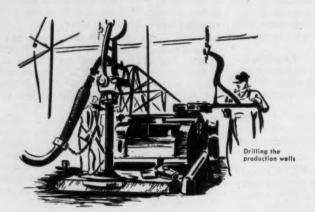


WIDER HYDRAULIC COVERAGE than for any other self-priming centrifugal chemical pump is provided by the new

CNGK. Chart shows coverage for 60-cycle motor speeds (50-cycle ratings on request).

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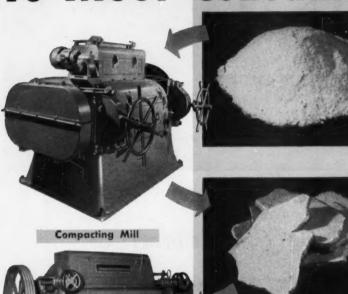
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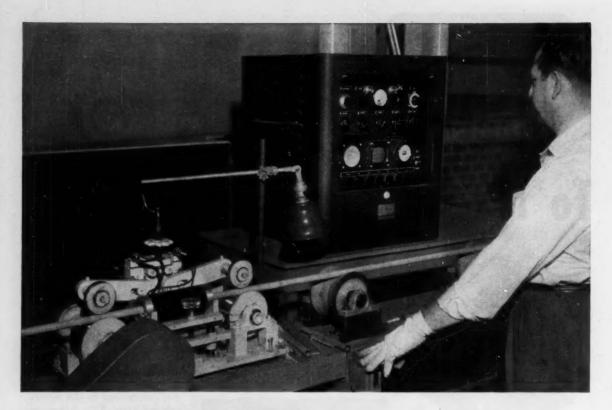
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Position requires experience in process and power piping arrangements, layouts and diagrams as related to chemical and petroleum industries. Experience should include basic piping fundamentals along with economical design layouts.

Principal duties will be to transform research and operating data into the design of new plants. Applicant will be expected to make independent analysis, exercise individual judgment, coordinate the work of others and make periodic trips to construction sites to assist in installation problems and start-ups.

### EQUIPMENT DESIGNER-ENGINEER

Qualifications will include experience in the design of equipment for either chemical or petroleum industries. Applicant should have a thorough knowledge of the ASME Code for Unfired Pressure Vessels and be familiar with fabrication and shop practices as they affect economical design.

Successful applicant will develop and analyze unique equipment designs for use in complex chemical processes that have heretofore been untried. Periodic trips to field installations and vendor shops will be required in order to view fabrication and installation of equipment and assist in start-ups.

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Personnel Relations Section Engineering Department

E. I. du Pont de Nemours & Co., Inc.

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### INSTRUMENT DESIGNER-ENGINEER

Desirable background will include experience in the application and installation of instruments for the control of chemical processes. Applicable design experience should be in pneumatic and electronic instrumentation for the measurement and control of process variables, including layout of complex graphic type panels.

Successful applicant will design and engineer systems as outlined above, giving consideration to economic installation and maintenance features. He will also assist in the development of control diagrams, prepare installation layouts and detailed hook-ups for unique application, write specifications and assist construction personnel in installation problems.

### POWER DESIGNER-ENGINEER

Qualifications will include background in the design of industrial plant facilities required to supply utility services to chemical processes. Applicable design experience should be in steam generation and distribution, water supply and treatment, refrigeration, fire protection, outside pipe lines, process waste disposal and industrial furnaces.

Designer selected will design and engineer a variety of the above mentioned facilities as are required by new or existing chemical processes. Work can involve not only economic installations, but also the challenge of meeting special requirements in connection with process problems.

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Successful applicant will analyze existing and proposed chemical processes for utilization of petroleum processing equipment and methods for obtaining greater yield and lower equipment investment, particularly with respect to hydrocarbon processes. Typical operations to be evaluated include solid fluidization, adsorption, reforming, and catalysis. This requires broad familiarity with equipment such as hypersorbers, distillation columns, cracking furnaces, low temperature refrigeration systems, and compressors. Other duties include trouble-shooting and equipment.

### **FLUID FLOW**

This position will require extensive experience with very complex fluid flow problems, such as are encountered in the following types of equipment: distillation, dust collecting, filtration, grinding, drying, matrials handling, absorption-extraction, and agitation and mixing. Successful applicant will develop specialized equipment such as jet reactors, jet compressors, jet absorbers, and pipe line reactors, and provide technical advice on fluid flow problems involved in handling slurries, plastics, highly viscous polymers, dispersion, and semi-solids.

### HEAT TRANSFER

Duties include: trouble-shooting on equipment, such as pipe line reactors, fluidized solids reactors, and film driers, where heat transfer is one controlling factor; selection of equipment, such as heat exchangers, evaporators, furnaces, and driers; evaluation of equipment to determine optimum alternatives; and theoretical analysis of problems in heat transfer in proposed equipment for new applications. Other typical heat transfer problems encountered involve reboilers, inert gas generators, direct fired production furnaces, and indirect fired retorts.

### INTERVIEWS IN SAN FRANCISCO

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For appointment, please call Mr. J. C. Costello, Jr.
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Or you may send complete resume, including details of education and experience, to:

Mr. J. C. Costello, Jr.

Personnel Relations Section Engineering Department

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Wilmington 98, Delaware

### DISTILLATION

This engineer will encounter problems of improvement in efficiency and increase in capacity of absorption, extraction, and distillation equipment, prescribing as necessary the modification of equipment in existing processes. Duties include: equipment specification for new processes and products; interpretation of data involving equilibria, using these data to develop equipment and to recommend operating conditions and methods of control; start-up assistance for new facilities; and trouble-shooting on operating difficulties.

### DRYING & DRYING EQUIPMENT

Most desirable qualifications include: substantial experience in the field of drying; a broad knowledge of mechanical drying equipment and their applications; and basic understanding of auxiliary equipment, such as pumps, ejectors, etc. Familiarity with heat transfer, fiuld flow, thermodynamics, and the mechanics of particulate solids is desirable. The successful applicant will be called on to develop unorthodox and unusual solutions to practical problems in drying particulate solids and sheet and fibrous materials.

### GRINDING

This position requires extensive knowledge of fine particle technology and broad experience with size reduction operations and equipment. The successful applicant will be called on to provide competent technical advice on: grinding in liquid media, dust collection and screening, size classification, equipment evaluation and selection, modification of existing equipment for unusual and special grinding problem and handling of finely ground materials. Problems encountered will provide opportunity for developing new concepts and extending the known technology.

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-I.R. Jet Refrigeration Unit complete 136 Tons 50° F to 43° F.

-Patterson 7'6° Conical Blender
rubber lined.

-Buflovak 6'x5'6" Monel Drum
Flaker NEW.

-Rietz 30' "Thermoscrew" Conveyor
Dryer 304 5'S NEW.

-Pfaudler 250 gal. Hastelloy "C"
Reactor.

-Pfaudler 250 gal. Hastelloy "C" Reactor. -4'x13' closed 316 5/5 Reactors, 109—3'6", 316 5/5 tubes 150 psi. -2500 gal. 316 5/5 jacketed Reactor. -Pfaudler 5'x18' Horiz. glass lined 2500 gal. -1500 gal. 316 5/5 5'x9' Vert. 200 psi. -7500 gal. 316 5/5 clad 12'x6'x-5'6" cone. -Link Belt 316 5/5 18"x12",

200 psi. 7500 gal. 316 S/S clad 12'x6'x-5'6" cone. Link Belt 316 S/S 18"x12", 18"x10', 18"x7' twin screw Con-

forated.

S/S.

D-Hydrators.

Super Centrifuges.

- 10-Day "Cincinnatus" double arm Sigma Blade, 660, 250, 100 and 50 gals.
  - Baker Perkins 100, 50 gal. Sigma Blades, jacketed.
    -Sprout Waldron S/S, jacketed Pow-

MIXERS

HIGH

MACHINERY

VALUES

- der Mixers 27 and 10 cu. ft. Struthers-Wells 6'x9' S/S, jacketed.
- Patterson 6' and 5' Steel Conical.
- Baker Perkins 2 gal. S/S.
  -Robinson 4000# steel Powder.
- Rodgers 400 to 3000# Powder.
- Simpson Intensive Mixers #0.
- NEW Portable Agitators 1/4 to 5 HP.
- -Day, Ross 8 and 50 gal., Pony.

### TOWERS—REACTORS CONDENSERS & TANKS

- 1—7'x30' Propone Tank 1-1/16" shell, 275# W. P.
- Horizontal Steel Tanks 10'x40', 10'x30', 1/2" shell.
- Towers 7'x25'6", 347 S/S, 6'x63', 6'x58' chrome-lined, 5'x96', 42"x49', 3'x53', 30"x80', 20"x50', 12"x50', 12"x30'.
- 4—Buflovak 4000 gal. steel, jacketed. agitated Reactors 50 psi.
- -10,000 gal. Aluminum Storage Tank 10'x16'x1/2" shell.
- Towers 7'x25'6", 347 S/S, 6'x63'. 6'x58' chrome-lined 42"x49', 3'x53'.
- Foster Wheeler Karbate Heat Exchangers 188 sq. ft.
- -Heat Exchangers 100, 200 and 300 sq. ft., 304 8/S.
- Heat Exchangers 50 to 2400 sq. ft. Admiralty and steel.

### MISCELLANEOUS

- 1-Foster Wheeler Dowtherm Unit with super heater, 41/2 million BTU.
- -Nash Vacuum Pumps #H-7, #H-6, #4, #2, #L5, #L3, #MD571.
- Beach-Russ #50D Vacuum Pumps, 50 cfm.
- Durimet, Olivite 316 S/S Duriron Centrifugal Pumps 1" to 3".

  -Centrifugal Pumps 60 to 2000 gpm.
- motor driven.
- Stokes #DDS2 and "R" Tablet Machines

- 1—Vulcan 8'x125' Rotary Kiln.
  3—Vulcan 6'x40', 5'x40', 5½x50'.
- Link Belt 3'10"x12", 5'2"x20', 7'5"x
- 20' S/S.
- Devine #27 double door Vacuum Shelf 17—59"x78" shelves. -Stokes #138-H Vacuum Shelf Dryer
- 10-44"x40" shelves. Struthers-Wells 5'x15' nickel Rotary Vacuum
- 1-Devine 5'x10' Steel Rotating Vac-
- Stokes 30"x8', 3'x15' Rotary Vac-
- Louisville 38"x25' Rotary Steam Tube.
- Buflovak Double Drum 42"x120", 42"x100", 36"x84", 32"x72". Buflovak 6' and 3' dia. Crystallizers.

### FILTERS

- Oliver Rotary, Monel 8'x10', 3'x2'.
  Feinc 5'x3' Monel. Rotary Vo Vac
- String. Feinc 3'x1', 316 S/S Rotary Vac
- String. Swenson Rotary 4'x2' nickel.
- Oliver 5'x3"x3' rubber lined Rotary Vac Precoat.
- Sweetland #12, 72 and 36 leaves.
- Sweetland #3, #5, #7, #10.
  Sweetland #3, S/S shell and leaves.
- Niagara 53 and 110 sq. ft., 304 S/S.
- Shriver 36" P&F 42 chambers.
  Shriver 30" P&F 30 chambers.
  Sperry 24" P&F 16 chambers.
- Sperry Aluminum 30"x24".

### PULVERIZERS—CRUSHERS

- -Ball & Jewell #2, #11/2 Rotary Cuttors. Devine 5'x10' steel jacketel Mill.
- -Hardinge Mills 41/2'x16", 6'x22'.
- 8'x36", 10'x48". Raymond #40 Imp Mill, 304 S/S.
- -Patterson 6'x8', 5'x6', 3'x4' brick lined Pebble Mills.
- NEW Patterson 6'x8' porcelain Pebble Mill 50 HP. National 6"x12" Plastic two-roll
- Mills. Gayco Air Separators 6', 3', 18" dia.
- Mikro Pulverizers #4TH, #2.

### SCREENS

- Rotex double and single deck 40"x120"
- Rotex double and single deck 40"x84".
- -Patterson single deck 40"x84", S/S. -Robinson single deck 40"x84", S/S.
- S. W. single deck 40"x84" S/S.

### Rotex three deck 20"x81".

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reactors

- -Tolhurst and Bird 32" & 40" steel S. S. rubber covered suspended type centrifuges
- -30" copper bubble cap column -36" cast iron filter press 18 chamber
- -7500# heavy duty double spiral dry powder
- New Stokes model T-5 tablet press
- -National Erie 8½" strainer -Buflovak 24" x 36" double drum atmospheric
- Buflovak 24" x 48" double drum vacuum dryer

- -2½-15-40 gallon Pony mixers -Buflovak 24" x 36" double drum dryer -Buflovak 24" x 48" double drum atmospheric drver
- -8-15-40 gallon Pony mixers
- -Rotex sifters 20" x 48" up to 40" x 84"
- -Double arm jacketed and unjacketed mixers, 21/2 gallons to 150 gallons
- 4-700 gallon steel mixing tanks, 2 HP, x proof
- 1-Simpson #2 style B mixer

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-UNUSED No. 12 Sweetland Filters, 48 brenze monel cov-ered lvs. 3" oc.

- 1-Ross dry pan mixer, 92"
- 2-300 gallon S/S jacketed and agitated processing kettle\*

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Note New Offices & Plant

2-Fitzpatrick Model D. S. S. Comminuters, XP

2—Sweetland & Kilby 650 sq. ft. SS Filters

1—Sharples model C-20 S/S Super-D-Hydrator

7—Pfaudler 200, 300 & 500 gal. jktd. glass lined

6—80 gal. S/S 347 autoclaves, 500# pressure 20—Sperry 30" iron p&f open filter presses 1—Ross 9" x 24" high speed 3 roll mill 1—Unused Haveg 750 gallon tank

20—S/S and karbate condensers, 4-1500 sq ft 1—International S/S 25 cu ft conical blender -Baker Perkins 500 gallon jacketed dispersion

8—5/5 Tyler Niagara 2' x 8' and 3' x 8' screens 1—Hersey monel 3' x 24' rotary dryer 5—Baird, Ruggles Coles and Louisville 4' x 30'

2-Patterson 3' x 4' porcelain lined pebble mills

to 6' x 35' rotary & tubular dryers -Patterson 4' x 4' chrome manganese jacketed

-Micro pulverizers #1 and 2 -Buflovak 17 shelf vac shelf Dryers

1—Unused 300 gal. S/S 316 jacketed reactor Alloy Fabricator S/S type 316 jacketed reactor

ball mills

bladed mixer

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2-6/8 Hersey Rotary Dryers, 8x26' and 6'x23'.
1-5502-16 Link Belt 8/S Rote-Louvre Dryer.
-6'8'x50' D. H. Ret. Dryers.
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  4.—Heat Exchangers, 12'' dia 1' g. 43 steel tubes.

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  Davenport Rotary Steam Tube Dryer, 8''x36''.

  2.—Stainless Steel Stam Jacketed Readeo Mixers.

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Abb Pabble A Tube Mill, 5'x22'—Buhrstone Lined.

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SCREENS SIFTERS SLITTERS

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Sparry & Shriver 12" to 36 sq. Iron & wood.

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i—0ops 350 gal. C. i. Jack. Vae. Kettle.
Dovine & Stokes Impres, Units 30" & 30" dis.
Dovine 1000 gal. closed Jack. Steel Kettle.
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i—2300 gal. Vert. agit. Jack. Steel Kettle.
i—2300 gal. Vert. agit. Jack. Steel Kettle.
i—250 gal. Lead-Lined Kettle.
i—260 gal. vert. distast Lined Tinks.
i—60 gal. vert. distast Lined Tinks.
i—60 gal. vert. distast Lined Tinks.
i—61 gal. vert. gal. Jack. Steel Kettle.
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i—82 Jack. Steel Kettle.
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Kent 3 HP. Centineous Dry Mixer.

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3-Day 15 & 40 gal. Peny Mixers.

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-So gal. Lead. Lined Kettle.

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-So gal. vert. Glass Lined Mill.

-So gal. vert. Glass Lined Tanks.

-So gal. vert. Glass Lined Mill.

-So gal. vert. Glass Lined Tanks.

-So gal. vert. Glass Lined Mill.

-So gal. vert. Glass Lined Tanks.

-So gal. vert. Glass Lined Mill.

-So gal. v

Hammer Mills & Pulverizers 3 to 50 H.P.
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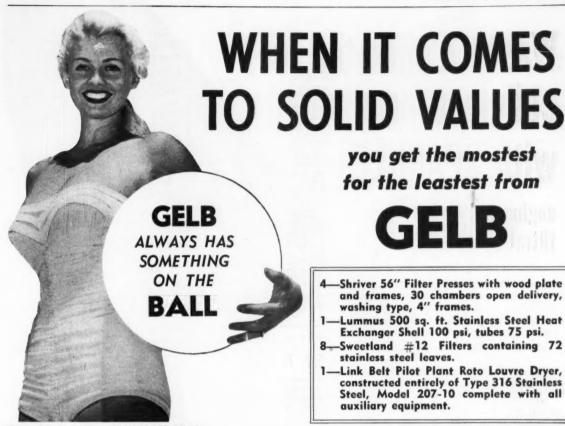
In view of the fact that there are almost no substantially complete sets available and because the set is in excellent condition, the asking price, f.o.b. Milwakee, is \$2000.00.

We were actually offered \$2000.00 five years ago and turned it down at that time.

W. J. COTTON 3530 W. Fairmount Ave. Milwaukee 9, Wis.

### FOR SALE

18—Jeffrey Mfg. Co. Power Units for tubular vibrating conveyor capable of conveying 40 ton per hour of 105 pound/cu. ft. material. No. 4MI for 440V., 60 cycle, mixed current operation, 72 amps maximum. Serial numbers 21527, 21532. Used 6 months only—in good condition. If interested, contact Purchasing Department, Mutual Chemical Division, Allied Chemical & Dye Corporation, 1348 Block Street, Baltimore 31, Maryland. Subject to prior sale or use. to prior sale or use.



you get the mostest for the leastest from

- -Shriver 56" Filter Presses with wood plate and frames, 30 chambers open delivery, washing type, 4" frames.
- -Lummus 500 sq. ft. Stainless Steel Heat Exchanger Shell 100 psi, tubes 75 psi.
- -Sweetland #12 Filters containing 72 stainless steel leaves.
- Link Belt Pilot Plant Roto Louvre Dryer, constructed entirely of Type 316 Stainless Steel, Model 207-10 complete with all auxiliary equipment.

THE GELB GIRL-JANUARY 1956

### **AUTOCLAVES—KETTLES** TANKS

- -Pfaudler Glass lined 150 gal. Jacketed Evaporating Pan with tilting mechanism.
- -Piaudler Glass lined 500 gal. Jacketed Re-
- 1—Cleveland Stainless Steel Jacketed Kettle, 3000 gallons (New). 2—Lee Stainless Steel Vacuum Kettles, 1000 gallons, with agitator and drives. 2—Pfaudler Glass-lined Jacketed Reactors, Series E, 200 gallons, with agitators and
- 2—Steel Vertical Rubber-lined Storage Tanks, 2500 gallons each.
- Plate Fabricators Steel Jacketed Kettle, 6000 gallons.
- 1-Nooter Steel Jacketed 750 gallon Reactor. 10—Patterson Steel Jacketed Kettles, 2500 gallons each, 40# Jacket 40# internal.
- 1-10,000 gallon Vertical Stainless Steel Storage Tank.
- 2—Horizontal Type 316 Stainless Steel Storage Tanks with agitator, 2500 gallons.
- 2—Horizontal Type 304 Stainless Steel Storage Tanks with agitator, 2500 gallons.

### CENTRIFUGALS

1—Bird Stainless Steel 48" Suspended Type Centrifuge, with perforated Basket, Plow and Explosion-proof motor.

- 1—AT&M Stainless Steel Centrifuge, 48" Imperforated Basket, complete with motor and plow.
- Thetcher Stainless Steel Suspended Type Centrifuge, 40" Perforated Basket, com-plete with motor.
- Sharples Stainless Steel Super-Pressurite Centrituge, Model 18 Y.
- 1-DeLavai Type 316 Multimatic Centrifuge.
- 1—AT&M Type 316 Stainless Steel Suspended Type Centrifuge, 20" Basket, complete.
- -Tolhurst Center Slung 12" Laboratory Cen-

### FILTERS

- 1—Feinc Type 304 Stainless Steel Rotary Vac-uum Filter string discharge, Size 3' x 3' (New).
- Oliver Rotary Vacuum Filter, Rubber-lined, 3 ft. x 6 ft., complete.
- Sparkler Filters, complete with pumps, Models 18-S-4, 18-S-8, 33-S-7.
- Shriver C.I. 38" x 38" Open Delivery Plate and Frame Filter Press, 35 ch.
   Shriver C.I. 38" x 38" Plate and Frame Closed Delivery. Washing Type Filter Press, 32 ch. with hydraulic closer.
- Shriver C.I. Plate and Frame Filter Press, 42" x 42". Open Delivery, 54 ch., with hydraulic closer.
- Sperry Plate and Frame Wooden Plate Fil-ter Press, 12" x 12", 15 ch.
- Chaires and Sharm Filter Press Skeletons and Frames from 12" to 36".

### DRYERS AND KILNS

- 1—Stokes 3' x 12' Stainless Steel Rotary Vac-uum Dryer.
- 1—Proctor & Schwarz Hot Air Dryer, 16 shelves.
- 1—Devine Stainless Steel Laboratory Vacuum Shelf Dryer, 3 shelves (New). 5—Buflovak & Devine Vacuum Shelf Dryers, 5 to 20 shelves.

### MISCELLANEOUS

- 1-Stokes DDS-2 Rotary Tablet Machine, 23
- Ames 90 HP, 125# PSI Package Boilers. 6—Karbate Style #VVFS-1 Heat Exchangers No. 22, Length 94".
- Karbate Heat Exchangers Series 90A, Size 96. Single Pass.
- 12—Struthers Wells Stainless Steel Reat Exchangers, 650 sq. ft.
- Swenson Walker Stainless Steel Jacketed Crystallizer, 29" long.
- -J. H. Day 200 gal. Stainless Steel T316 Double Arm, Sigma Blade Jack-eted Mixer.
- -Banbury Mixer midget size with 2 HP
- -Lancaster 5' dia. Muller Mixer.

PLASTIC and FOOD PROCESSING MACHINERY CHEMICAL, RUBBER OIL U.S.HIGHWAY No.22, UNION, N.J. MUrdock 6-4900



One of the South's largest producers of cellulose, the Southern Chemical Cotton Co., Chattanooga, Tenn., obtains its water from the City of Chattanooga. This is river water coagulated with alum and passed through gravity sand filters. The chemical and physical properties of this water vary over a wide range due to great fluctuations of demand and change in river conditions. At times conditions are very detrimental to Southern Chemical's cellulose production.

During the conversion of raw cotton linters into chemical cotton, a large amount of water is used. The fine cotton fibres filter out and retain any trace particles contained in the water. Thus, objectionable minerals would discolor and contaminate the material. This resulted in the production of off color cellulose, above specifications of certain elements.

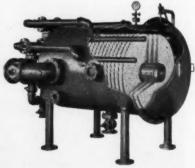
Three Model SCJ-40-25 Sparkler Water Filters, having a total filtering area of 1,200 square feet, were installed to alleviate this condition. These filters handle more than 5,000,000 gallons of water per day and efficiently remove the particles which formerly caused Southern Chemical's production difficulties. Plant officials credit their Sparkler water filter installation with eliminating a troublesome production problem and helping consistently to produce a product of satisfactory quality.

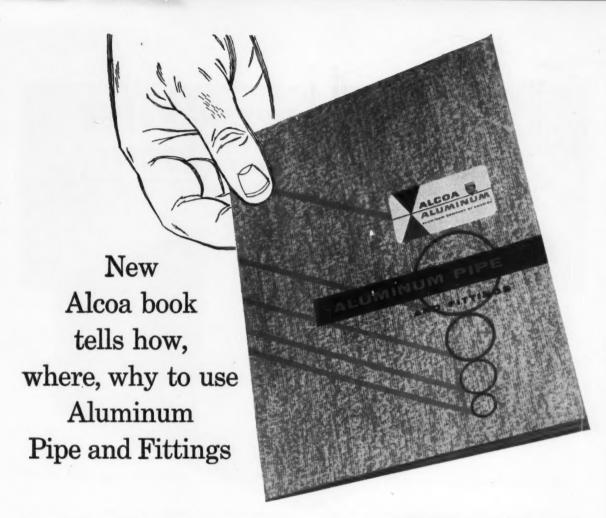
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Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia • Service representatives in principal cities throughout the world.

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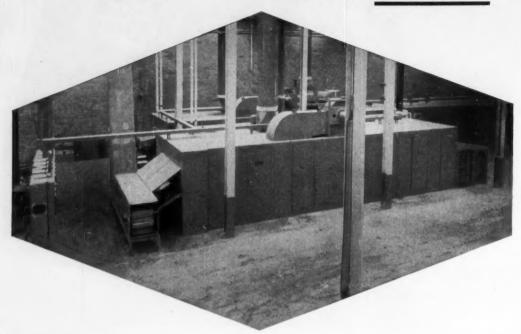
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Efficient drying per pound of product can often mean more direct profit to you than an increased sales volume! Proctor equipment provides the control, flexibility, and construction features essential to profitable drying performance. The result—increased yield of highest quality product. Write or phone today for complete information.

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- \* "W/M" CONSTRUCTION
- \* FLEXIBILITY OF OPERATION

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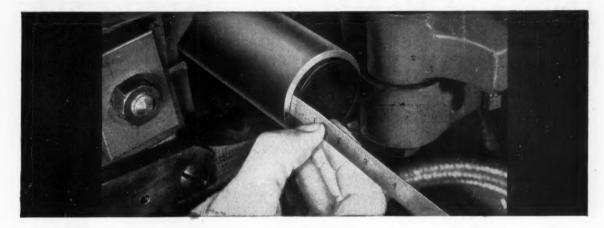
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## **CUTS CORROSION COSTS**

Corrosion resistant Saran Pipe swaged into steel is your answer to downtime losses.

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STEEL PIPE

Saran Lined Pipe is Manufactured by The Dow Chemical Company Midland, Michigan



A large chemical company uses this installation to convey demineralized water. It has a perfect record of keeping the water free of contamination for five years!



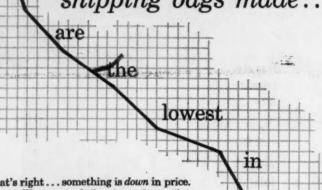
Saran lined pipe used for conveying hydrochloric acid at temperatures from 20° to 90°C., has had no unscheduled interruptions due to corrosion for over two years!

you can depend on **DOW PLASTICS** 



# Prices of Bemis Waterproof Bags...

the strongest shipping bags made...



That's right...something is down in price. Bemis Waterproof (laminated textile) Bags are \$20 to \$30 per thousand less than two years ago... and the lowest priced in 15 years.

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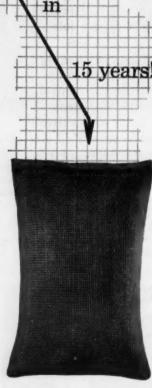
- 1. Those of you who may be using lower priced containers that don't give adequate protection and consequently cost you money.
- Those who are using more costly containers which could be amply replaced by the economical, sturdy Bemis Waterproof Bags.

Compare total costs...including container, handling, storage and damage costs. You may easily find Bemis Waterproof Bags will save you money and headaches. Ask your Bemis Man for details.

P.S. —The lower price is due largely to the lower price of burlap, of course. Indications are the burlap situation will remain stable, so Bemis Waterproof Bag prices should also remain stable.

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COMPLETE CATALOGUE

# Reader Service

A. J. BABKOW, MANAGER J. E. FLANAGAN, EDITOR

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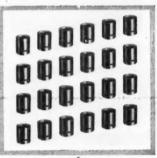
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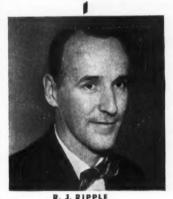
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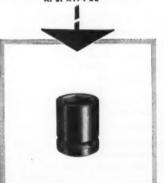
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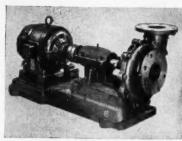
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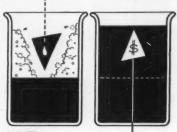
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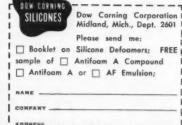
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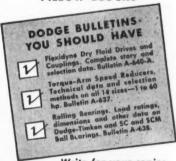
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- Chemicals....."Ready Reference to the Chemicals You Live By" is a pocket-size folder which provides a handy, helpful list of Diamond chemicals for quick reference. Copies are available upon request.

  368Q Diamond Alkali Co.
- Chemicals....Mallinckrodt's flexible production facilities are geared to precision manufacture of chemicals from a few tons to carload lots. Brochure lists and describes company's chemicals and their uses,

  368R Mallinckrodt Chem. Wks.

- Chemicals, Agricultural......16 p. multigraphed Bulletin on Lindane tells all about its physical and chemical properties, provides formulations, outlines uses, and presents numerous application recommendations. 3868 Diamond Alkali Co.
- Chemicals, Industrial.....Company produces several widely used chemical products derived from redwood bark. Reference contains data on uses, properties and characteristic behavior. Request Bulletin 4-03.

  368T Pacific Lumber Co.
- Chemicals, Molybdenum.....Company announces the availability of an informative reprint covering their product line . . . a commodity review on production and uses of molybdenum chemicals. Bulletin No. Ch-7.

  368U Climax Molybdenum Co.
- Chemicals, Organic, Synthetic.....1956
  edition of "Physical Properties of
  Synthetic Organic Chemicals" is now
  available. Presents latest data on
  more than 350 organic chemicals. Request Booklet No. F-6136,
  368V Carbide & Carbon Chem.
- Chemicals, Oxygen, Active.....Company makes available upon request a literature reference covering line of active oxygen chemicals. Becco per-oxygen compounds are listed and described. Builetin No. 1.

  368W Buffalo Electro-Chem. Co.
- Chemicals, Badlochemicals......Special Catalog serves as an introduction to the whole field of research with radio-active chemicals. Reference contains product listings, formulae, specific activities, etc.

  368X Baker & Adamson Products.
- Cyclohexanone.....From Hopewell, Va.
  —substantial new basic production of
  cyclohexanone. It is the highest-quality, volume-production cyclohexanone
  yet to be offered. Technical data and
  samples available.
  368Y National Aniline Div.
- Defoamers, Silicone.....Defoamers have proved their efficiency and versatility in countiess applications. Offers a new booklet with complete information on Dow Corning Antifoam agents plus a product sample.

  R365

  \*Dow-Corning Corp.

#### Contents of This Issue . . .

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- sors ..... 394
- Services and Processes.. 397

Depressants.....Water-blocked oil wells restored by Atpet 931 . . a highly effective interfacial tension depressant. Atpet 931 Booklet outlines technical characteristics and methods of use. Available on request. 369A Atlas Powder Co.

Detergents, Non-Ionic......Wipe out foam problems with Triton CF-10. This new non-ionic detergent answers the problem of excessive foaming in cleaning compounds. Request detailed information and product samples, 369B Rohm & Hass Co.

Dibutyl Phthalate.....CSC's dibutyl phthalate has achieved recognition as the outstanding plasticizer for polyvinyl acetate emulsion paints. Company makes available complete data and a product sample on request. 3690 Commercial Solvents Corp.

p-Dichlorobenzene.....Made in seven different sizes. Each size has its advantages—tops for repackaging & the crystals make a firm, dry, non-oczing block or pellet of exceptional whiteness. Bulletin 454. 71b \*Hooker Electrochem. Co.

1,4-Dichlorobutane.....Low price & availability of this alpha, omega dihalide in tank car quantities should permit commercial development of many syntheses formerly thought to be too costly. Technical Bulletin.

369D E. I. du Pont de Nemours.

Diethyl Malonate..... Dow diethyl malonate, for years a valuable intermediate in the manufacture of barbituates, is finding many other uses in research and production. Request complete data and an evaluation sample. 269E Dow Chem. Co.

Dimethyl Suifoxide......Potential uses include: desulfurization & separation of petroleum fractions by selective solvent action; paint removal; solvent for acetylene & other gases; etc. DMSO Technical Bulletin.

369F Stepan Chem. Co.

Dioctyl Phthalate.....A truly high quality dioctyl phthalate whose combination of low color, low odor, low acidity, high heat stability & high ester content is unsurpassed. Specifications & sample quantities.

3696 Eastman Chem. Products.

Dust Concentrate, Pyronyl.....Company offers a new "Prentox Information Bulletin" containing a suggested label outline for Prentox Pyronyl Dust Concentrate in combination with Rotenone & fungicides.

369H Prentiss Drug & Chem. Co.

Elastomers.....Kel-F Elastomer is a fluorocarbon rubber developed to help solve problems of rubber application under severe operating conditions. For more information, request Booklet, "Kel-F Elastomer."

213 \*\*M. W. Kellogg Co.

Epichlorohydrin.....An intermediate for the revolutionary epoxy resins, as well as for a whole new family of dyestuffs, solvents, plasticizers, & adhesives. Information in Technical Booklet No. SC: 49-35. 135

\*Shell Chem. Corp.

Esters, Cellulose.....If you need a film to protect...to decorate...to seal ... to cushion...to mask—investigate the cellulose esters made by Eastman. Offers complete property information. 3691 Eastman Chem. Products.

Esters of Parahydroxybenzoic Acid......

If your product is among the many that are subject to mold and bacterial attack, it will pay you to investigate the Parasepts as preservatives. Data and samples.

369J Heyden Chem. Corp.

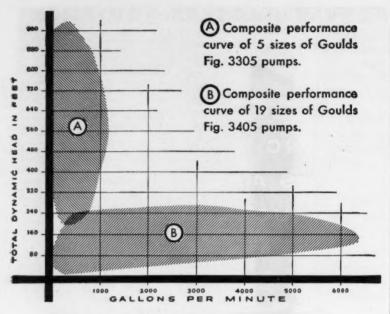
Formaldehyde.....U. F. Concentrate-85
Is highest concentration of liquid
formaldehyde commercially available
...59% formaldehyde and 26% urea
in a water solution. Request samples
and valuable Folder.
121

#### DENVER PROCESS EQUIPMENT DENVER assures positive agitation and circulation. Patented wearing plate prevents sand-up an (patented) 3'x 3 shut-down. Heavy duty as well as acid-proof construction is available in both open-type, air lift and Super Agitater madels. Please write for Bulletin No. A2-84. SUPER 20'× 20' AGITATORS and MIXERS A Denver Steel-Head Ball Mill will suit your DENVER A Denver Steel-read Balt Mill Will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Laboratory and pilot plant mills also available. Please write for Bulletin No. 82-813. 3'x 2' Steel-Head 6'x 12' BALL MILL Denver Rake Type Classifiers are available in sizes from 1'-6" x 14'-8" to 8' x 21'-8". Denver Spiral Classifiers range in size from 6" x 5'-8" to 60" x 3'-4". Denver Hydro Classifiers are available in diameters from 6' to 35'. All are designed to efficiently separate fine particles in specific applications. Please write for bulletin No. C3C-8. 18" to 60" DENVER Wide Suitable CLASSIFERS Length Cast Steel Frame, manganese jaw and cheek plates. Large diameter shafts reduce shaft deflection and thus increase life of heavyduty, oversize roller bearings in bumper. Setting easily controlled. Please write for Bulletin No. C12-B12. DENVER Forced-Feed 21/4"x 31/2" IAW 32"× 40" CRUSHER Accurately meters minute quantities of liquid Accordary meters minute quantities of incute from 0 cc to 2000 cc per minute. Float valve in tank permits connection of teeder to bulk storage device. Handwheel adjustment to control amount of liquid is simple and ac-DENVER O cc Wet Reagent 2000 cc FEEDER curate. Used in multiples for higher capacities. Please write for Bulletin No. F6-89. Special, patented design of segments in Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pan Filters. Please write for Bulletin No. F9-B2. DENVER 1 Disc. 2' Disc 8 Disc, 6' FILTER Flotation is the selective separation of parricles from each other in a liquid pulp by means of air bubbles. More large plants are installing Denver "Sub-A's" for their entire DENVER Laboratory "Sub-A" and floation job, because they give maximum recovery at a low cost per ton. Dependable, low-cost, simplified continuous operation. Please write for Bulletin No. F10-881. Commercial FLOTATION A mechanically operated, longitudinally re-ciprocating table consisting of a deck hav-DENVER ciproceting table consisting at a deck having a plane surface partly riffled and a tilt-ing device. It separates materials into bands and handles the coarsest sands with excel-lent results. Ideal for separation of groups of particles having a similar range of spe-cific gravities. Write for Bulletin No. T1-B3. Wilfley Concentration TABLES Batch and continuous test models of Crushers. Screens, Ball Mills, Pulverizers, Rad Mills, DENVER Classifiers, Agitators and Mixers, Pulp Dis-tributors, Feeders, Flatation Machines, Pumps, Batch LABORATORY Thickeners, Filters, Dryers, Tables, Samplers. Results obtained on Denver Laboratory Equip-Continuous EQUIPMENT ment can be duplicated by commercial ma-chines. Please write for Bulletin No. LG3-B10. 2'x 15' to 5'x 40' and larger Available in several types: Direct Heat, Indirect Heat, and Steam Tube. Let DECO Engineers solve your drying problem. No dryer problem too small or too large. Please write for Bulletin No. D4-82. DENVER Standard DRYERS The firm that makes its friends happier, healthier and wealthier



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<sup>•</sup> From advertisement, this issue



## Do you need pumping capacity?

... or head? ... or both?



Goulds Fig. 3405 single-stage pump.

Goulds Fig. 3305 two-stage pump.

With these two groups of Goulds centrifugal pumps you can meet an extremely wide range of pumping requirements.

For volume pumping, 19 sizes of the Fig. 3405 single-stage, double-suction pump provide capacities up to 6,400 GPM, and heads to 280 ft.

For greater pressure requirements 5 sizes of the Fig. 3305 two-stage pump provide heads up to 1,000 ft., and capacities to 1,200 GPM.

Both of these groups of pumps have important new design and construction features that insure efficient operation and long life. Yet, because so many of their parts are interchangeable, you can cut your parts inventory in two—or better.

For example, you need only 3 different shafts for all 24 sizes of

pumps in both groups.

We'd like to send you additional details about these pumps, including specifications and performance curves. Just write for Bulletin 721.6 about the Fig. 3405 single-stage pumps, and Bulletin 722.6 about the Fig. 3305 two-stage pumps. We'll be glad to send you copies of both.



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### LITERATURE . . .

- Gum, Arabic.....Many uses: in textiles, confectionery, pharmaceuticals, lithography, matches, adhesives. Foam stabiliser in brewing. In whole, granular & powder form or in purified syrup form. See Bulletin.

  376A Jacques Wolf & Co.
- Hydrogen Peroxide.....Purification of Metal Salt Solutions with Hydrogen Peroxide"—a review of the use of hydrogen peroxide for removal of iron from various chemical process solutions. Bulletin No. 26.
  370B Buffalo Electro-Chem. Co.
- Hydrogen Peroxide.....Preparation of alkali cellulose & of viscose described & effects of hydrogen peroxide added to promote aging of alkali cellulose & ripening of viscose discussed. Request Bulletin No. 30.

  379C Buffalo Electro-Chem Co.
- Lithium Aluminum Hydride.....\$p.
  covers; valuable data: molecular
  weight; color & form; stability; solubility; chemical reactions—inorganic;
  chemical reactions—organic; handling
  & use; etc. Bulletin 40.
  370D Metal Hydrides.
- Lithium Borohydride.....Offers technical information on lithium borohydride. Features valuable uses: organic reducing agent; hydrogenation agent; hydrogen generation; etc. Find complete details in Bulletin 402.

  370E Metal Hydrides.
- Lithium Carbonate.....Product has had its greatest use in the ceramic and chemical manufacturing fields. Announces the availability of a Data Sheet describing density, solubility, typical analysis, uses, etc. 54a \*Lithium Corp. of America.
- Lithium Chloride.....Data Sheet covers: molecular weight; color & form; density; melting & bolling points; solubility; density of aqueous solutions; typical analysis; grades & strengths; packing; uses; etc.

  54b \*\*Lithium Corp. of America.
- Lithium Hydroxide.....Data Sheet covers its uses: storage batteries; gas absorption; pharmaceutical chemicals; multi-purpose greases; lubricating oils & lithium salts. Technical Data Sheet available upon request.

  54e \*Lithium Corp. of America.
- Lithium Titanaie......Uses—ceramics:

  (enamels)—as a mill addition in
  titanium-bearing enamels for effecting
  lower burning; (glazes)—used as a
  mill addition in vitreous & semivitreous glazes; etc. Data Sheet.
  54d \*Lithium Corp. of America.
- Lubricants, Molybdenum Disulfide..... Lists 17 types & tells of the importance of this compound in extreme bearing pressure, & high, low & normal temperature lubrication applications. Bulletin No. 103A, 370F Alpha Molykote Corp.
- Lubricants, Synthetic..... In such applications as processing textiles, packing coffee, etc., Ucon vacuum-pump lubricants dissolve troublesome gums & sludge-forming comtaminants in evacuation air. Technical data. 3766 Carbide & Carbon Chem.
- Lubricants, Synthetic Wax.....Acrawax
  C is an organic product which fires-off
  completely, leaving no residue. Can
  be readily incorporated in a wide
  range of powdered products. Samples
  & catalog, "Synthetic Waxes."
  370H

  Glyco Products Co.
- Methyl n-Propyl Ketone.....Covers physical properties, specifications, shipping data, solvent data on resin solubilities, performance in nitrocellulose lacquers, etc. Request Bulletin No. F-8780.

  3791 Carbide & Carbon Chem.
- Molding Compounds, Fibercore.....Technical Data Folder describes new fiber-glass reinforced materials . . . of high impact strength . . but in lightweight metal range (specific gravity approximately 1.8). 370J Plumb Chem. Corp.

<sup>\*</sup>From advertisement, this issue

- Molding Compounds, Nylon.....Presents molding characteristics and physical properties of Plaskon Nylon \$200. Discusses the ease of moldability of this material, its relatively low molten viscosity, etc. 8 p. Barrett Div.
- Molybdenum....."The Use of Molybdenum as a Fertilizer in Australia" is a survey of Australian practice prepared by the Commonwealth Scientific and Industrial Research Organization. Bulletin No. Ag-8, 371B Climax Molybdenum Co.
- Molybdenum Pentachloride.....Presents detailed reference, "Properties of Molybdenum Pentachloride"—a review of the more important physical and chemical properties of this compound. Bulletin No. C6b-3.

  371C Climax Molybdenum Co.
- Moss, Irish.....Used where highly soluble viscous mucilage is desired, such as cold water paint, shoe polish, leather and textile sizing. In neutral, bleached or purified powder forms. Special Bulletin. 371D Jacques Wolf & Co.
- Olis & Waxes, Fluorocarbon.....Illustrated 20 p. booklet contains detailed information on KELF fluorocarbon oils, waxes and greases: chemical structure; specifications; applications; properties; etc.

  371E M. W. Kellogg Co.
- Paraffins, Chlorinated.....Makes availaable Data Sheet describing Chlorowax 70 S ... a 70% chlorinated paraffin with exceptional heat stability suitable for use with polystyrene, vinyls, polyethylene, etc. 371F Diamond Alkali Co.
- Pentaerythritol.....Just what alkyd resin manufacturers have been looking for—an all-purpose pentaerythritol that combines higher purity and uniformity with real production economy. See Celanese P. E. Bulletin, 3716 Celanese Corp. of America.
- Perchlorethylene.....6 p. Folder describes Diamond perchlorethylene for professional drycleaning at its best, outlines advantages it gives to drycleaners; also includes physical properties of this new solvent. 371H Diamond Alkali Co.
- Persulfates.....Offers reference, "Uses of Persulfates—A Bibliography"—a selected list of literature references based on "Chemical Abstracts," & covering period from 1907 to 1950, Request Bulletin No. 34.

  3711 Buffalo Electro-Chem. Co.
- Phenobarbital USP Powder.....An odorless, white powder having a somewhat bitter taste. Uses—a sedative, hypnotic and antispasmodic in human and animal treatment. Full details in Technical Information Sheet. 371J Mallinckrodt Chem. Wks.
- Pigments, Molybdate.....Valuable reprint entitled, "Evaluating Molybdate Pigments as Corrosion Inhibitors," discusses possible use of slightly soluble molybdates in white and tinted inhibitive paints.

  371K Climax Molybdenum Co.
- Plasticizers.....Illustrated, 80 p. describes Flexol line: summary of physical properties: performance in PVC compounds; physical properties as related to performance characteristics; etc. Book F-5882C, 371L Carbide & Carbon Chem.
- Polyvinyl Acetate Emulsion....Polyco 679 for water-resistant adhesives... a 55% solids anionic type emulsion developed for use in non-discoloring high temperature heat-seal adhesives. Data and samples.

  Borden Co.
- Polyvinyl Materials.....Products made from Geon red vinyl include corrosion-proof pipe, fumes ducts, tanks, trays, materials that can be machined, planed, sawed, drilled, and cemented. Offers technical information. 9 \*B. F. Goodrich Chem. Co.

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ZINC DUST
AS A
REDUCING
AGENT

## Federated Zinc Dust offers these advantages:

- 1 Original cost is lower than most commonly used agents.
- 2 Works in alkaline and acidic solutions of varying pH; also in aqueous and alcoholic solutions.
- 3 Yields a salable zinc by-product.
- 4 Effective in both organic and inorganic reactions.

FEDERATED METALS is the country's largest producer of zinc dust with plants at Trenton, N. J. and Sand Springs, Okla. We maintain extensive research facilities which permit us to give you active help on your particular problem. Particle size and control of Federated Zinc Dust allow us to meet your specific requirements.

FREE SAMPLE. Send for a free half-pint sample of Federated Zinc Dust for testing as a reducing agent. Investigate it, too, as a catalyst and as a polymerizer. Just fill in the coupon below.

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DIVISION OF AMERICAN SMELTING AND REFINING COMPANY 120 BROADWAY, NEW YORK 5, N. Y. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal

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ederated irst in the non errous ield	Name	Title	_
	Company Street Address	Zone State	

<sup>\*</sup>From advertisement, this issue



With the introduction of our latest, improved design Package Type Generating Plants, production of high purity Oxygen and Nitrogen simultaneously increases production 60% over the production of Oxygen alone, plus a corresponding reduction in the cost of manufacture. Due to its compact design, a minimum of floor space is required and streamlined panel assembly insures instant visibility of all control gauges. Stock sizes from 1500 to 10,000 cu. ft. per hour. Larger and smaller sizes available. 99.99% Argon available on large size plants.

We invite your inquiry.



- Potassium Borohydride.....White micro-crystalline power—soluble in water, alcohols, liquid ammonia. Nonhygroscopic. Stable in air. Decomposes in vaccum at 500°C. Complete details contained in Bulletin 301-B. 372A Metal Hydrides.
- Potassium Titanium Fluoride.....New data sheet includes information on: chemical formula; physical and chemical properties; typical analysis; packaging; uses; etc. Request copy of Technical Data Sheet KCC-101. 372B
- Prepargyl Halides.....Three centers of reactivity. Chemical intermediate for terpenes and pharmaceuticals, etc. Agricultural uses as soil fumigant, etc. Announces availability of technical information and samples.

  3720 General Aniline & Film Corp.
- Reodorants, Industrial......"Alamask"
  TAL can be used in direct processing of crude tall oil, masking the odors & allowing this material to be used in preparation of sanitary, textile & specialty soaps. Full data.
  372D Rhodia, Inc.
- Resins.....Exon 481 has exceptional tensile strength . . . over 1,000 lbs. per sq. in, with an elongation factor up to 200%. Soluble in ketones, compatible with plasticizers, stabilizers & pigment types. Request complete information.

  69

  \*Firestone Plastics Co.
- Resins, Acrylic.....Lucite acrylic resins available with a wide range of molding characteristics & properties & in a variety of transparent, translucent & opaque colors. Offers descriptive literature on request. 149a \*E. I. du Pont de Nemours.
- Resins, Epoxy.....Furane Plastics has completed detailed studies on semirigid epoxy resins (Epocast 9Aformulations cast in conjunction with "Flexibilizer T"). Request Bulletins EP-54-10a, EP-55-61. Furane Plastics.
- Resins, Epoxy.....Illustrated, 32 p. reference, "Bakelite Review," includes a valuable section on epoxy tooling—"On Stream With Epoxy Tools"—the first in a series of case histories. October. 1955.

  372F Bakelite Co.
- Resins, Nylon.....Zytel is the du Pont trade-mark for a versatile group of long-chain synthetic polymeric amides exhibiting extreme toughness & strength. Complete data on properties & applications on request. 149b \*E. I. du Pont de Nemours.
- Resins, Polyamide.....Illustrated, 16 p. contains data about Versamids plus specific information on each of the eight types currently marketed by General Mills. "Versamids A Demonstration in Resin Versatility."

  152-3 "General Mills."
- Resins, Polyethylene.....Tough, flexible
  Alathon polyethylene resin stands up
  well against abrasive slurries. Widely
  used in industrial pipe applications.
  Offers complete information on the
  properties and applications.

  149e

  \*E. I. du Pont de Nemours.
- Resins, Polyvinyl Chloride.....Data
  Sheet gives a typical analysis of Diamond PVC-50 polyvinyl chloride resin,
  summarizes its advantages for wire
  insulation, calendered film & sheetins, & other applications.
  372-G Diamond Alkali Co.
- Resins, Resorcinol-Formaldehyde.....
  Synvaren PLS-R is a "stopped" resorcinol-formaldehyde resin for use with
  latex in treatment of rayon & nylon
  for subsequent adhesion to rubber.
  Bulletin 12-198-0-10-55.
  372H Harwick Standard Chem. Co.
- Resins, Tetrafluoroethylene ......Teflon tetrafluorethylene resins used extensively in process industries. Offer chemical inertness, high heat resistance, low-temperature toughness, etc. Properties & applications.

  149d \*E. I. du Pont de Nemours.

<sup>\*</sup> From advertisement, this issue

- Resins, Vinyl..... Coatings based on Bakelite resins are tough, durable & tenacious—resist acids, alkalies, salt air & water, temperature extremes, rough service, "Bakelite Resin Coat-ings for Industry." Bakelite Co.
- Exon 450 is a vinyl chloride copolymer.....

  Exon 450 is a vinyl chloride copolymer resin of intermediate molecular weight which may be used in solution resin work. Properties & characteristics in Bulletin No. 13.

  373B Firestone Plastics Co.
- Silicones.....Lists various "Linde" sili-cones, in liquid & solid forms, in broad categories of water repellents; olls & oll emulsions; electrical insulating resins; etc. Request copy of Catalog No. F-50002. resins; etc. No. F-50002. Linde Air Products Co.
- Soda Ash.....Releases an information Folder on Trona soda ash. Includes data regarding production, various grades of soda ash, distribution and other material pertaining to industrial applications, 373D American Potash & Chem. Co.
- Soda, Caustic....."Caustic Soda Buyer's Guide" contains helpful facts on eco-nomics of 50% & 73% solutions; other forms of caustic soda; capacities of tank cars & other containers; useful shipping data; etc. 71c \*Hooker Electrochem Co.
- graphed Bulletin is a compilation, in outline form, of 71 known industrial uses and patented applications of sodium bichromate. Also includes summary of potassium bichromate. 373E Diamond Alkali Co. Sodium
- Sodium Carboxymethylcellulose.....De-tergency-grade Carbose is a special CMC for promoting home & commer-cial soaps & detergents. Makes avail-able valuable technical information & product samples of Carbose. 373F Wyandotte Chem. Corp.
- Sodium Sulfite Anhydrous Photo Granular
  .....Fine, white, free-running crystalline granules; odorless. Chiefly used in photographic developing and fixing solutions. Details in Technical Information Sheets.

  3736 Mallinckrodt Chem. Wks.
- White porous powder, m.p. 230°C., with decomposition. Evolves hydrogen with water. Soluble in organic solvents. Makes available complete product information in Bulletin 504, 373 H
- ent Recovery.....Barnebey-Cheney pre-piped package recovery systems pay for themselves even though handling as little as 400 Cfm. See "Solvent Recovery Actually Takes Dollars out of the Ar"—Bulletin 821-53.

  3731 Barnebey-Cheney Co.
- Solvent Recovery.....New 36 p. reference gives technical information on activated carbon and describes the efficiency and economy of recovering solvent vapors in a variety of industries. Form No. 4410D.

  3734 Carbide & Carbon Chem.
- Specialties....."Lavender Reinforcer R.P." was developed after many requests for a specialty which would reestablish the light note often lost in preparation of lavender formulations. Product sample and data.

  Rhodia, Inc.
- Tetrahydrofuran.....Finds increasing use in applying top coats of high molecular weight polyvinyl chlorides to polyvinyl chloride sheeting and supported fabric. Makes available an informative Technical Bulletin.

  373L E. I. du Pont de Nemours.

\* From advertisement, this issue

# INDICATING TEMPERATURE CONTROL



#### OPERATION-

Automatic ambient temperature compensation permits use of a solidly liquid-filled bellows, bulb and capillary assembly which is a precise type of wide range temperature sensing element.
The mechanical movement of the

bellows is precalibrated to actuate a snap-action switch to close, open or transfer electrical circuits any setting between scale limits. A close on-off differential is produced, uniform at all tempera-

## COMPENSATION:

Each model of the Type E32N is automatically compensated for ambient and overtravel temperatures to maintain the control point at its calibration accuracy under all conditions met with controls of this type.

#### ACCESSORIES:

Capillary Armor • Separable Socket • Union Connector

New bulletin contains complete information. SEND FOR IT TODAY.



New design\* gives control point accuracy equivalent to individually calibrated instruments.

> After many years experience in the design and manufacture of temperature and pressure controls United Electric has developed this instrument with a calibration feature designed so that it is even possible to replace the thermal unit in the field with no loss of calibration accuracy. It contains a 12-inch scale which rotates against a fixed index permitting extremely high readability.

\*Patent Applied For

#### FEATURES:

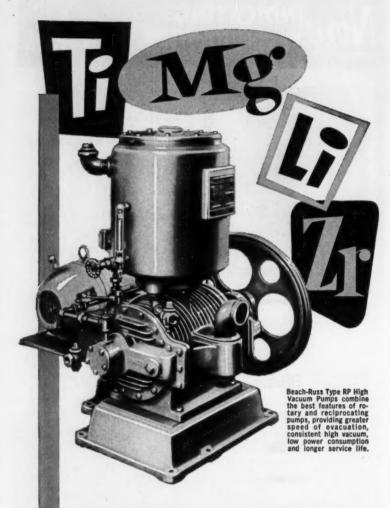
This precision built instrument designed to control and indicate temperatures of gases, liquids or hot plates over wide ranges has the following important features:

- Calibrating mechanism permits precise matching of the scale to the individual tolerance errors of thermal assemblies.
- 12-inch scale allows easy reading of small values - even on wide
- ranges.

   Scale rotates against a fixed index pointer, placing all readings in a vertical and centered location to prevent errors due to parallax. Automatic compensation for am-
- bient temperatures. Thermal assemblies may be replaced in the field with no loss of
- calibration accuracy. Simple design permits lower cost than comparable instruments.
- Models cover wide ranges from -150° F to +650° F.
- Universal case for flush panel
- or surface mounting.

   Bulb styles available for many applications including mechanical convection or gravity type ovens, laboratory testing cabinets, molding machines, incubators, hot plates and water baths.





Whether it is titanium, magnesium, lithium, zirconium, germanium, calcium, silicon, vanadium, etc.... if your process requires vacuum operation, your working vacuum can be reached faster and at lower cost with

## BEACH-RUSS Rotary Vacuum Pumps

The Beach-Russ Type RP Pump is used extensively in processes involving vacuum or inert atmospheres for induction or arc melting, heat treating, alloying or refining. This versatile pump is available in capacities from 20 to 1800 c.f.m. for any laboratory, development or production work. It can be used on either a straight mechanical system, or in combination with a diffusion pumping system for higher vacuums.

The superior design, high efficiencies and slow operating speeds make the Beach-Russ Type RP Pump the best available mechanical pump for your work. Catalog 90 tells the full story.

BEACH-RUSS COMPANY
50 Church Street · New York 7, N.Y.

### LITERATURE . . .

N-Vinyl-2-Pyrrolidone.....Will copolymerize with almost all vinyl monomers. Permits modification of many properties in existing homopolymers. Request technical information, price schedules, and product samples. 374A General Aniline & Film Corp.

.

An ingredient contributing smoothness, unctuousness and covering power to pharmaceutical and cosmetic preparations. Details in Technical Information Sheet. 374B Mallinckrodt Chem. Wks.

Zircenium....Numerous important uses acid-resistant materials, corrosionresistant materials, electronic getter, scavenger, etc. Furnishes pertinent technical data on company product line in Bulletin 700.

Metal Hydrides.

## **Construction Materials**

- Alloys..... Hastelloy alloy B is resistant to hydrogen chloride gas at high temperatures, wet or dry, & to hydrochloric acid. Readily fabricated & has high-alloy steel strength. Request booklet of product line.

  235

  \*Haynes Stellite Co.
- Alloys, Aluminum Bronse.....Illustrated, 32 p. booklet, "W W Premium Quality Aluminum Bronzes," includes valueable information on properties, specifications, applications, etc. Technical Data Bulletin 15.100-1. 374D W W Alloys.
- Alloys, Fabricated.....Illustrated, 36 p. covers both heat-& corrosion-resistant fabricated alloy products of company. Includes: furnace muffles; furnace trays & fixtures; retorts; etc. Catalog G-10.

  374E

  Rolock. Inc.
- Castings.....Casting a 1½ lb. stainless steel instrument housing demands design conferences etc. For the full story of how this "impossible" casting is being cast on the production line, request AKH Study #8. 93e \*Cooper Alloy Corp.
- Castings, High Alley..... Covers facilities for producing high alloy static & centrifugal castings & offers data on castings used for resisting high temperatures, corrosion & abrasion. Bulletin No. 3150-G. 388 \*Duraloy Co.
- Coating Systems, Protective.....New
  Ucilon coating systems give chemical
  engineers effective weapons against
  corrosion. Systems based on neoprene
  coatings for air dry or force dry application. Bulletin No. MC-9,
  62a \*United Chromium.
- Coatings, Protective . . . . . For any equipment or surface that can be uniformly baked . . . Plastisol compounds offer easy, economical way to apply longlasting vinyl coating protection. Data in Bulletin No. VP-1.

  62b \*United Chromium.
- Fabrication, Stainless Steel.....Feature the techniques of fabricating equipment with round corners for efficient service—round corners are stronger...easier to clean. Guide provides complete information.

  284

  S. Blickman, Inc.
- Fabrication, Steel & Alloy Plate.....Illustrated 48 p. describes the facilities
  and workscope of large fabricator—
  offering the latest techniques in custom fabrication of steel and alloy
  plate. Catalog No. 554.

  \*Nooter Corp.
- Film & Sheeting, Cast Vinyl.....Krene Cast Vinyl Film offers valuable benefits...especially for packaged foods, hardware, soft-goods, and many other products. Request product samples and informative Booklet. 374F Bakelite Co.

<sup>•</sup> From advertisement, this issue

- Insulation, Industrial......N<sub>0</sub> matter where your insulation job may be—Armstrong can give you efficient, well-integrated, on-the-job service from original specs to final installations. Booklets describe full line.

  271 \*Armstrong Cork Co.
- Irons, Cast.....Specifications for six classes of metallurgically controlled irons are itemized in new bulletin, "Precision Cast Irons," Lists both mechanical properties & tested applications, 24 p. 375A McNally Pittsburg Foundries.
- Paints, Protective.....Tygorust & Tygon
  "ATD" are companion products to
  make your fight against corrosion less
  costly—more effective. You can get
  better protection. For the full story,
  write for the TYGON Manual.
  102
  \*U. S. Stoneware.
- Refractories......Carborundum has pioneered scores of super refractories with a wide variety of properties to meet your most demanding requirements. For complete details, request Refractories Booklet.

  87
- Refractory Grain.....24 p. reference, "Norton Refractory Grain," offers many charts, tables and photographs in color—a wealth of information on nature, performance, and application of refractory grains.
- Steels, Nickel Plated . . . . . For heavy, industrial use—CF&I Lectro-Clad nickel plated steel provides economical protection against product contamination & discoloration. Request new Technical Manual.

  249 \*Colorado Fuel & Iron Corp.
- Titanium Sponge..... Resists chlorides & other corrosive chemicals as no other structural metal can. Offers general booklet on titanium plus new technical bulletin with data on corrosion-resistant properties.

  39 \*E. I. du Pont de Nemours.

## **Electrical & Mechanical**

- Casters......Featuring Darnelloprene treads (a soft, resilient Neoprene rubber compound) ... casters offer ease of movement, quietness, and protection for floors. Manual contains complete information.

  L387 °Darnell Corp.
- Chain Roller.....Adaptable to power transmission or conveying. Positive, flexible, economical chain with high sustained efficiency. Lock-type bushings result in long roller chain life. 148 p. Data Book 2457.

  57

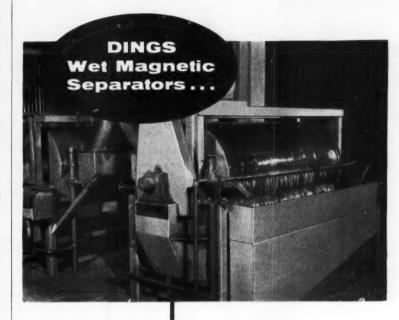
  Link Belt Co.
- Drives, Shaft-Mounted.....These versatile speed-reducing units save space, power, material, and time. Includes selection, application, and dimension details in the new, completely illustrated, engineering Bulletin.

  63a

  Falk Corp.
- Lighting Equipment, Emergency.....

  Makes available complete information describing the Dynaseal power bloc (Bulletin No. A-46) and Dynaseal lifetime emergency lighting units (Bulletin No. A-71).

  375B Dynaseal Lighting Corp.
- Lubrication Systems....."Spray Valve
  Panels" are designed to spray-lubricate bull gears, girth gears such as
  on grinding mills & kilns, & other
  spur or herringbone gear trains. Details in Bulletin No. 26-R.
  3756
- Motor Starter-Circuit Breakers.....Design, construction & performance of circuit breaker & motor starter Unilets give maximum safety & unparalleled ease of wiring, installation, maintenance. Bulletin BH. 33 "Appleton Elec. Co.
- From advertisement, this issue



for Maximum Efficiency
and Economy
in all classes
of separation
and Concentration

• In heavy-media separation, Dings Wet Drum Magnetic Separators assure maximum recovery of magnetite and ferrosilicon . . . up to 99.8%.

In direct concentration service, selective separation possible with Dings design assures rejection of high tonnages of low iron non-magnetics in rod or ball mill cobber positions and consistently high grade silica-free concentrates from finisher separators.

Whatever your separation or concentration problem, over 50 years of specialized experience, backed by actual field trial where required, is available to assist you in selecting the best type of separator to solve your specific needs.

DINGS MAGNETIC SEPARATOR CO. 4716 W. Electric Ave., Milwaukee 46, Wis.



For further details, send for Bulletin B-1500.

send for Bulletin B-1500.

DINGS MAGNETIC SEPARATOR CO.
4716 W. Electric Ave.
Milwaukee 46, Wis.
Please send copy of Bulletin B-1500.

Name\_\_\_\_\_Title\_\_\_\_\_

Address.

City\_\_\_\_\_\_ Zone\_\_\_\_ Stafe.

WC155-2/3



Specially designed for handling the high-temperature liquids now being used in vapor phase heat transfer, this new "Buffalo" Pump has already proved its reliability.

The "Q" Factor\* features listed below will show you the care that has gone into its construction. For ability to handle heat transfer liquids efficiently, the performance of this pump is assured.

If you are concerned with a problem of heat transfer by a liquid medium, write us today for recommendations from our Engineering Department.

## These Quality Features!

- 1. Extra-deep water-cooled stuffing boxes
- 2. Smothering gland
- 3. Water-cooled bearings, large oil reservoir
- 4. Special packing (mechanical seals optional)
- 5. Colmonoy-coated shaft sleeve thru stuffing box
- 6. Flexible all steel coupling
- 7. Cast steel casings and sideplates
- 8. Centerline support

\*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.



## **BUFFALO PUMPS**

DIVISION OF BUFFALO FORGE COMPANY

501 BROADWAY •

BUFFALO, N.Y.

Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

#### LITERATURE . . .

- Motors..... Howell Series 180 motors are smaller, lighter and cooler running. New reference shows clearly the important advances in design that have been built into these new rerated motors. Bulletin N-100-R.

  376A Howell Elec. Motors Co.
- Motors.....Data book shows how & why the New Standard, smaller motors outperform the larger, heavier ones. Weight savings to 40% plus space savings. Request Bulletin No. 6-1P1. 241 \*Century Electric Co.
- Motors......Describes newly designed standard & explosion-proof enclosed motors, featuring corrosion-resistant cast iron frames, improved winding insulation & heavy duty ball bearings. Bulletin No. MU-203.

  68 \*Wagner Elec. Corp.
- Motors, Air.....A new Model 6AM rotary air motor of 2 hp, weighing only 17 lbs., enlarges Gast line to 5 sizes, ranging from 1/20 to 4 hp. Performance curves and data contained in Bulletin No. 855-10.

  376B Gast Mfg. Corp.
- Motors & Generators . . . . . A complete line of motors and generators designed to meet product requirements is illustrated in a new.. available literature reference. Request "A Company With A Future Invites You."

  376C Marathon Elec. Mfg. Corp.
- Motors, Totally-Enclosed.....Precisionengineered & precision-built to new NEMA standards—ideally suited to "air-over-motor" applications where moisture, fumes, dust, etc. are a problem. Bulletin No. CE-3394. 79 \*Diehl Mfg. Co.
- Motors, Varidrive.....With a U. S. Varidrive motor you can get instantly all the speeds needed for every operating condition. For informative full color references, request Booklets Nos. 1882 & 1797.
- Reducers, Speed.....40 p. covers "Line-O-Power" speed reducers with capacities ranging from fractional hp to 150 hp. Includes complete engineering data & specifications for all models. Engrg. Manual LP.
  219 \*Foote Bros. Gear & Mach.
- Reducers, Speed. . . . . Take up a minimum of space. Power is transmitted with a smooth, uniform torque flow. Found throughout the chemical & allied industries where a right-angle drive is needed. Catalog 400.

  12 \*Cleveland Worm & Gear Co.
- Seals, Mechanical.....Describes a new series of Unitary mechanical seals... designed for use on rotary shafts of boiler feed pumps, chemical pumps, oil refinery pumps, etc. Illustrated Bulletin No. AD-151. 376D Garlock Packing Co.
- Seals, Mechanical.....Combining chemically impervious teflon with a balanced bellows design—Chemiseal external mechanical seals last longer & give unsurpassed performance. Details in Bulletin No. MS-1155.

  293 \*U. S. Gasket Co.
- Seals, Mechanical.....For pumps, agitators, autoclaves and similar processing equipment. Furnishes the complete story of new line of Chempro "wedge-lock" mechanical seals in illustrated Bulletin No. CP551. 301 \*Chemical & Power Products.
- Seals, Mechanical, Rotary—Company announces the availability of a new 8 p. reference which shows how you get maintenance-free sealing that slashes fluid mixing cost to a new low. Illustrated Bulletin B-111.

  123f \*Mixing Equipment Co.
- Seals, Packaged......New addition to "John Crane" family of anti-corrosive Type 9 Seals is the answer to a simplified means of seal installation (or removal) in modern split-case pumps. Seal catalog.

  289 \*\*Crane Packing Co.

<sup>\*</sup> From advertisement, this issue

# MAKING Rain Vrop **BUTAY WAY...**



Outside Redler elevates material from track hopper to discharge either at storage tank or to 30 ft. inclined conveyor which in turn delivers to a horizontal conveyor on the plant roof.

This 5-inch Redler conveyor on roof receives material from the 30 ft. inclined Redler and in turn carries it 51 ft. to the point of discharge into plant (right foreground).



Close-up view of Redler ele-vator showing double leg at head end, assuring perfect discharge. Discharge is to storage or to roof conveyor. Rate 10 tons per hour. Sealed casing of Redler permits outside operation without



Complexity of layout is illustrated by this interior processing station photo. Skip delivers to mixer which dumps to hopper feeding L type Redler. Mix is then de-livered to packaging machine or to storage.

There is an S-A sales engineer in your area. Contact him for sound advice in your conveying problems.

## WITH AN S-A ENGINEERED BULK MATERIAL HANDLING SYSTEM!

Manufactured by the Butay Products Company, Los Angeles, "RAIN DROPS" is a water softening and blueing agent. To provide swift, economical conveying and mixing of this product's base ingredient, Stephens-Adamson engineered a system which saves many costly material handling hours.

Completely automated, this system consists of a batch skip, mixer unit, and L-type sealed casing Redler conveyors which eliminate all dusting problems. From the point of delivery outside the plant to the packaged product itself, raw material moves swiftly and smoothly by 100% mechanical means.

The Butay installation is an outstanding example of Stephens-Adamson overall planning. More than 50 years' experience in designing and manufacturing equipment that conveys at lowest cost per ton qualifies S-A for any assignment in mass movement of bulk material.



#### STEPHENS-ADAMSON MFG. CO.

3 Ridgeway Ave., Aurora, III. Los Angeles, Calif. - Belleville, Ontario

ENGINEERING DIVISION

Designers and manufacturers of all types of bulk materials convey-ing systems,

STANDARD PRODUCTS

A complete line of conveyor acces-sories—centrifugal loaders—car pull-ers—bin level controls, etc.

SEALMASTER DIVISION A full line of in-dustrial ball bear-ing units available in both standard and special hous-

# McGraw-Hill Mailing List Will Help You

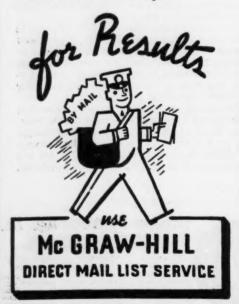
- Merchandise your advertising
- Conduct Surveys
- Get leads for your salesmen
- Get inquiries about your product or service
- Pin-point geographical or functional groups
- Sell Direct
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- Aid Dealer Relations

Direct Mail is a necessary supplement to a well rounded Business Paper advertising program.

600,000 actual names of the top buying influences in all the fields covered by the McGraw-Hill publications make up our 150 mailing lists. These lists are built and maintained primarily for our own use, but they are available to you for Direct Mail purposes. Pick out a list of YOUR prospects from our Industrial Direct Mail Catalogue.

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## We have a house to put in order...

WE HAVE A HOUSE to put in order... and it's the house where America lives.

Of our country's many million homes, more than 1 out of every 10 are out-and-out slums. Nearly one-half of all American dwellings are in poor to "fair" condition, and urgently need basic repairs.

Something *must* be done-both to correct the slums of today and *prevent* the slums of tomorrow.

How do slums start? Usually just one house starts to slide downhill and soon a whole block changes. Pride is lost. Other houses are neglected, decay spreads.

So the 20 million homes in need of basic repair and improvements deserve equal attention. The time to stop the spreading blight of slums is *before it starts*.

## What's your stake in stopping slums?

If you think your town is different, just look around you ... If you think slums only affect persons who live in them, think again.

Slums raise taxes and lower property values of the whole town. They raise rates of crime, delinquency and disease. Everyone has a real stake in stopping slums. And that includes you as a businessman.

Your firm is certainly dependent on the welfare of the community where you do business. But it's more than good business—it's good citizenship to take part in efforts aimed at civic improvements. It's the responsibility of every business.

What can your firm do? The answer to America's housing problems starts with individuals. But to roll back slums is such a big job it's going to take more than individual effort. It will need the cooperation of your business and many others.

Some slums should be torn down and a fresh start made. Others can be remodeled and made to conform to better living standards. So it is up to you to support every sound program which seeks adequate housing for all our people.

### New help is now available

There is a new national, non-profit organization called A. C.T.I.O. N.—The American Council To Improve Our Neighborhoods—which is designed to help all individuals or groups interested in putting America's house in order.

Send for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It lists booklets, research, check-lists, and other material which can help you. Address P. O. Box 500, Radio City Station, New York 20, N. Y.



American Council To Improve Our Neighborhoods

# he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils...reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine—the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it"—"they" being all the industry's front line of innovators and improvers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you—giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.



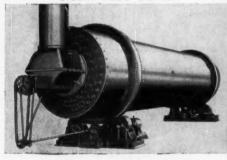
## McGRAW-HILL PUBLICATIONS



6'-0" Diameter

## "DAVENPORT" ROTARY

Steam Tube DRYER





## DRYING WOOD CHIPS

The above dryer is used for drying various species of hard wood chips from saw mill waste that are further processed into chip core panels.

Let our engineers consult with you on your Pressing, Drying, and Cooling problems, or send for complete Catalog A



davenport MACHINE and POUNDRY COMPANY

## Does A Six-Week 500% Return On Equipment Cost Stir Your Imagination?

(A CASE HISTORY)

In the processor's own words . . . "More than 750 tons of hydroforming catalyst were processed in the first six months. This included catalyst of widely varying quality . . . Increased value of the recovered catalyst is more than five times the original cost of the equipment. In addition, continued use of the equipment will reduce hydroforming operating costs considerably by reductions in fresh catalyst purchases ... The specific gravity separators are probably the most important items of equipment in the plant ... Utilization of the equipment for separation of other types of catalyst used at (name of plant) is under consideration."

In both particle and bulk form, the ½8-inch catalyst pellet, described above, is not unlike many other types of dry chemical and industrial materials. And, although this particular application of Sutton equipment is spectacular, it represents only one of more than a hundred different types of chemical and industrial products being successfully separated, salvaged, cleaned, or classified through use of the famous sixty-seven year-old SS&S Process — "the separation of dry materials by effecting differences in specific gravity through air-flotation."

Consider your own processing problems carefully. From fourteen basic models, incorporating 64 different types and sizes of Specific Gravity Separators and Air-Float Stoners, Sutton may be able to provide an immediate and profitable solution.

May we send you a reprint of the complete "catalyst story"? Or, better still, drop us a line describing your particular separating problem.

SUTTON, STEELE & STEELE, INC. 1031 SOUTH HASKELL . DALLAS, TEXAS

Mailing your inquiry on company letterhead directly to Dept. C (at the above address) will greatly facilitate its prompt handling.



where tube fouling is present

# The Paracoil self-cleaning heat exchanger

eliminates all down time for cleaning. In addition the continuous action of the baffles permits the exchanger to always function at its maximum rate of heat transfer, which on an overall cost basis makes this Paracoil exchanger, dollar for dollar, the most economical buy in the industry.



This specialized design is typical of the ability of Paracoil engineers to solve varied heat exchanger problems. You may have a need for its application in your plant. We're as handy as your phone or mail box.

## NGINEERING CORPORATION

20, N. Y. . 1064 EAST GRAND ST., ELIZABETH 4, NEW JERSEY



#### LITERATURE . . .

Transformers, Control.....Illustrated, \$2 p. describes complete line of G-E control transformers. Includes auto-transformers, machine tool transformers & special application models. Request Catalog GED-2767.

378A General Elec. Co.

Turbines, Steam.....Turbines range from 150 horsepower down to frac-tional in 6 frame sizes. Feature large number of manually operated valves number of manually operated varies for individual control of steam noz-zles. Details in Eulletin 135. \*Coppus Engrg. Corp.

## Handling & Packaging

Bulk Material Body.....New Baughman Model SF-5 Bulk Material Body with full hydraulic operation offers its user faster delivery, bigger payloads and less maintenance. Illustrated Bro-chure furnishes full details. 378B Baughman Mfg. Co.

Carriers, Straddle.....Company an-nounces a straddle carrier with load hooks which pivot inward to permit carrying without bolsters. Describes outstanding advantages and specifi-cations in illustrated Folder. 3780 Clark Equipment Co.

Closing Devices.....New Sperry Hand-raulic closing device—easiest to in-stall & operate—brings filtration economy to new or existing filter presses. Booklet covers simple erec-tion & operating directions. 26 \*D. R. Sperry & Co.

Conveying Systems.....Explains how the Fuller-Kinyon conveying system was successfully expanded to keep pace with increased production of fin-ished tale when plant capacity was almost doubled. Reprint GDM-28. 378D Fuller Co.

Conveyors.....Handle packages, parts, units—faster—at reduced cost with gravity or power roller, belt, slat, chain, wheel or push-bar conveyors. Specifications, drawing & application data in Bulletin No. 309-CE. 294 \*Standard Conveyor Co.

Feeders, Rotary Airlock ..... There's a Prater rotary airlock feeder for any of these materials: phosphate rock, volcanic ash, cement, sewage sludge, plastics, bauxite, etc. Request illus-trated Brochure. 290 Prater Pulverizing Co.

Feeders, Wet Beagent.....Accurately meter minute quantities of liguid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Data in Bullein F6-B9.

369e \*Denver Equipment Co.

\* From advertisement, this issue

#### Keeping too busy?

You'll find our streamlined Reader Service section right up your alley. It's designed for busy engineers who want to find things fast, get more informa-tion fast. RS is easy to use, and you can bank on it.

# Designed to Make Your Filter Work Better...

By reducing internal resistance to flow so that pressure drop is across the filter cake and not between the chamber and manifold.

By keeping the filter leaves internally clean.

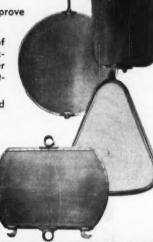
By careful field engineering service to improve their operating efficiency.

Multi-Metal's designs incorporate all types of standard rim construction—continuous, leak-proof closure—rigid, free-drainage chamber—balanced flow. Reversible flow and bottom waste discharge are optional.

Let our engineers study your problems and make recommendations.

Bulletin 544 tells more.





MULTI-METAL WIRE CLOTH CO., INC.

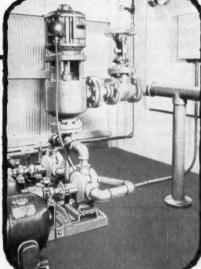
## Viking Pumps help Clopay Save \$10,000

Installation of two Viking Pumps and a continuous pipe line mixer enabled Clopay Corporation, Cincinnati, Ohio, to mix their own oil and resin coating solution for window shades. As a result, Clopay purchased materials separately in tank cars at 20% lower

per year

Because of Viking Pump's positive action, liquids are uniformly mixed in spite of widely varying viscosities, yet unloading requires less time than formerly.

If your plant has a pumping problem requiring accurate mixing, try Viking Pumps. Write today for information and bulletin 56Sc.





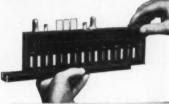
VIKING PUMP CO. Cedar Falls

In Canada, it's "ROTO-KING" pumps
NAL "GEAR - WITHIN - A - GEAR" ROTARY PUMP

## TAYLOR COMPARATORS

help you control

- CRYSTALLIZATION
- **BLEACHING**
- PRECIPITATION
- **EXTRACTION**
- WASTE TREATMENT



with fast, easy
PH and
CHLORINE
analyses

Handy kits help you control unit operations and waste disposal with fast, accurate colorimetric analyses . . . right on the spot. By Taylor's simple visual methods, you can determine pH, chlorine, bromine, phosphate, QAC, nitrate and metal ions quantitatively in only three easy steps . . . just take your sample, add reagent and read direct after comparing with a standard. Test kits are completely portable for use by plant supervisors and foremen as well as in the laboratory.

## COLOR STANDARDS GUARANTEED

Taylor liquid color standards carry an unlimited guarantee against fading . . . no danger of mechanical inaccuracy. Each complete set of standards is mounted in a lightweight, durable plastic slide . . . no single standards to handle.

CALL YOUR LABORATORY SUPPLY HOUSE



W. A. TAYLOR AND



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and

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EQUIPMENT

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INDUSTRIES



# McNally Centrifugal PUMPS

Special Built McNally Pittsburg centrifugal pumps are used to handle abrasive and corrosive sludges, slimes, and slurrys. They give maximum pumping service for years.

In these slurry pumps, the volute, impeller, wearing plate and suction nozzle are cast of McNally specification NiHard. The pumps are of open impeller, single stage type. They are direct connected, or v-belt driven, depending on the type of service and installation requirements.

SPECIAL DESIGN

McNally Pittsburg designs special centrifugal pumps to your requirements; or builds special pumps to your design. For Information Write to Either Plant.

#### MANUFACTURING SERVICES

Specification Cast Iron Heavy Machining Stress Relieving

Assembly Platework Structural Steel

Consulting Services without Obligation
WRITE FOR DESCRIPTIVE BULLETINS

## MCNALLY PITTSBURG

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OFFICES: 307 North Michigan, Chicago, Illinois
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PLANTS: Pittsburg, Kansas Wellston, O

#### LITERATURE . . .

- Loaders, Industrial.....Describes Model
  NL-50 front wheel drive Napco
  Loader...with no clutch shifting for
  directional control. Includes the
  numerous features and specifications
  in illustrated Form NCE101.
  380A Napco Construction Equip. Div.
- Materials Handling..... When time is important in handling dry materials in bulk . . rely on Fuller systems (Fuller Kinyon Airveyor, Airslide, Fuller-Fluxo). Data in "How To Pull Dollars Out of Thin Air."
  72 \*Fuller Co.
- Materials Handling Equipment.....50 p.
  contains technical data, descriptions & photos of vibratory feeders, conveyors, power tools, shaft seals, selenium rectifiers, etc. Condensed Catalogue 5510.

  Syntron Co.
- Packers, Bag.....Fully illustrated, .12
  p. describes Stoker bag packers . . .
  designed to handle powdery, granular
  or pelleted materials. Includes outstanding features, operation, applications, attachments, etc.
  3800 H. L. Stoker Co.
- Packaging....."Here's How it Pays to Package in Film Made of Bakelite Polythylene Plastic" illustrates the packaging of farm products, hardware & industrial products, plant, food & drug products, etc. 386D Bakelite Co.
- Scales, Checkweight..... Describes new checkweigher utilizing flexual platform with strain-gage load cell weight transmitter and integrally mounted belt conveyor. Features, applications, etc. Catalog 21.

  380E Weighing Components.
- Separators, Magnetic.....Type K magnetic separator provides powerful magnetic field which attracts feebly magnetic particles. Purifies & concentrates bulk chemicals where other methods fall. Complete details in Bulletin No. 701B. \*Stearns Magnetic
- Tractor-Loaders.....TL-6 Tracto-Loader features a short turning radius & combines a tip-back bucket with hydraulic torque converter drive & clutch-type transmission. Illustrated features & specifications.

  380F Tractomotive Corp.
- Tractor-Shovels.....Describes entirely new, % cubic yard, 2-wheel-drive Payloader. Features: "pry-out" bucket action; 40 degrees of breakout at ground level; new safety & stability standards. Request literature.

  3806 Frank G. Hough Co.
- Tractor-Shovels.....Two new Payloader tractor-shovels (Model HU 1 cu. yd. & Model HH 1½ cu. yd.) offer many features: more horsepower; easy to operate; accessibility; torque-converter drive; etc. Full data.

  89 \*Frank G. Heugh Co.
- Tractors, Trackmobile.....The Whiting heavy-duty Trackmobile moves many heavily loaded freight cars at low cost. Describes tractive effort, specifications, dimensions, features, etc., in Bulletin No. T-115.

  380H Whiting Corp.

#### Keeping too busy?

You'll find our streamlined Reader Service section right up your alley. It's designed for busy engineers who want to find things fast, get more information fast. RS is easy to use, and you can bank on it.

<sup>\*</sup> From advertisement, this issue

Trays, Dryer.....Toteline's fiberglass resin reinforced Dryer Trays resist non-oxidizing acids, corrosive saits, weak alkalis, and many other chemicals. Offers complete information on all Toteline models.

381A Molded Fiberglass Tray Co.

## **Heating & Cooling**

- Bollers, Packaged Automatic.....Offer valuable features: low-cost, space saving installation; fast steaming; instant response to load changes; quick fuel change-overs; clean, dry steam; etc. Data in Bulletin 1220, 217

  Orr & Sembower.
- Coils, Heating & Cooling, Test Procedures
  .....Releases valuable HCCMA reference. "Standard Methods of Testing
  and Rating Forced-Circulating AirCooling and Air-Heating Coils." Request Bulletin No. 202.
  381B Heating & Cooling Coil Mfrs'.
- s, Water.....Aerofin Type "R" Re-movable-Header Water Colls offer valuable features: complete drain-ability; easily cleaned; high heat transfer. For complete information, request Bulletin No. R-50. 308 \*Aerofin Corp.
- Coolers, Fluid . . . . Describes Trane Dry Type Fluid Coolers, units developed specially for economical liquid or gas cooling. Covers construction, percooling. formance, maintenance, component parts, etc. Bulletin S-395.

  Trane Co. component
- Generators, Steam.....16 p. book gives capacities, dimensions, construction features, instrumentation, accessories, sectional drawings & installation photos on new series of steam generators. Bulletin PG-55-3.

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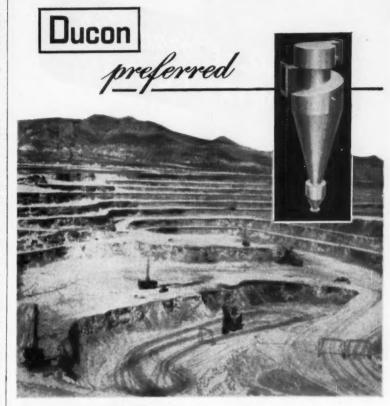
  \*Foster Wheeler Corp.
- Generators, Steam.....Company releases its latest catalog describing its products and services, which include not only the well-known Wickes steam generators but also custom metal fabrication. Bulletin 55-1.

  381D Wickes Boiler Co.
- special interest to the chemical, oil processing & other basic industries is a new reference on heat exchange equipment—Drayer-Hanson Cal-Fin Tubing. Bulletin No. 3008.

  361E Drayer-Hanson.
- Heat Exchangers.....For corrosive or non-corrosive liquids and gases. In-dustrial builds these to suit the job and can furnish all auxiliary pumps, piping and fittings. Request Bulletin No. 600-2. 307 \*Industrial Filter & Pump.
- t Exchangers.....Aero heat exchanger cools liquids & gases by evaporative cooling with atmospheric air, removing the heat at the rate of input, controlling temperature precisely. Data in Bulletins 120 & 124.

  \*Niagara Blower Co.
- Heaters, Electric.....Check Chromalox electric heat for your application. See F1550—"101 Ways to Apply Elec-tric Heat." To get details about heat-ers for electroplating industry, re-quest Bulletin No. 750. 16 \*Edwin L. Wiegand Co.
- Heating Systems, Dowtherm.....Furnishes descriptive information on Dowtherm heating systems for processes requiring precision control of high constant temperatures at low pressures, in Bulletin ID-54-5.

  137 \*Foster Wheeler Corp.
- Refrigerating Machines, Absorption.....
  Machines which produce large-capacity cooling from steam, have no major moving parts & use plain water as a refrigerant, are fully described in 36 p. Catalog A.I.A. 30-F-22.
  381F Carrier Corp.



## ... for Dust Collection in **Anaconda's Yerington Mine Operations**

**Ducon Cyclone Collectors** are used for dust control on the various operations at Anaconda's Yerington, Nevada Copper Leaching Plant. Crushing and related operations are the starting point in the preparation of many raw materials for subsequent use, whether it be for metallurgical, chemicals or construction. From exploratory drilling through the various processes to the end product, **Ducon Dust Control Equipment performs** the vital service of product recovery and dust control in the many material processing operations.

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Canadian Branch: THE DUCON COMPANY of CANADA, Ltd. 275 James Street North, HAMILTON, ONTARIO

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COMPANY

Designers and Manufacturers of Dust Control Equipment Exclusively CYCLONES . CENTRIFUGAL WASH COLLECTORS . TUBULAR CLOTH FILTERS . DUST VALVES

<sup>\*</sup>From advertisement, this issue



Are you using wire cloth or wire cloth parts which must be corrosion resistant? Are the service conditions in your plant really tough? If you have a problem selecting the proper anti-corrosive alloy, Newark Wire Cloth may have the answer.

Available in all corrosion resistant metals, Newark Wire Cloth is accurately woven in a wide range of meshes, ranging from very coarse to extremely fine.

If you have a wire cloth problem involving corrosion, please tell us about it . . . we may have the answer.



#### LITERATURE . . .

Traps, Steam.....In toughest chemical processing service, Nicholson pays off 4 ways: lower initial cost; less upkeep expense; faster warm-up; faster production. For complete trap data, request Catalog No. 953.

40 •W. H. Nicholson & Co.

Tubes, Condenser.....For condenser & heat exchanger tubes & plates specify Revere—cupro-nickel—30%, 10%; admiralty metal; arsenical copper; aluminum bronze—5%; etc. "Life Extension for Condenser Tubes."

263 \*Revere Copper & Brass.

Vaporizers, Dewtherm......Firetube
Dowtherm vaporizers & heaters provide safer, more dependable heating
& low maintenance. Includes diagrams
of nine basic Dowtherm systems in
detailed 28 p. Bulletin A-100.
283 \*\*Eclipse Fuel Engrg. Co.

## Instruments & Controls

Alarms, Flow, Vibration Proof.....F&P
has now made it possible to produce
the first flow alarm completely insensitive to vibration. For details
of the numerous features, request
Catalog 10-A-84 (Pub. 11514).
382A Fischer & Porter Co.

Analyzer-Recorders, Oxygen-Combustibles
.....Provide a continuous two-inone check of combustion efficiency
by recording both oxygen & combustibles in flue gas. Product Specifications Nos. E65-1 & E12-5.

\*Balley Meter Co.

Analyzers, Oxygen.....New brochure describes Model F3 Oxygen Analyzer. Includes operating principle, typical applications in a wide range of industries, and helpful technical data. Bulletin No. 108A. 382B Arnold O. Beckman.

Analyzers & Recorders......Chart final yield and H2-N2 ratio before and after recycle gas enters feed stream. L&N Analyzers have been proven successful throughout the process industries. Folder ND46-91(2).

98 \*Leeds & Northrup Co.

Centigrade-Fahrenheit Conversion Tables
.....Facilitates conversion between
Centigrade & Fahrenheit scales, from
absolute zero to 3350 C (or 6062 F)
in increments of one degree. Request
Note Book EN-33(1),
382C Leeds & Northrup Co.

Comparators.....Fully illustrated, 100 p. tells how to use pH and chlorine control for water supplies, process solutions, production processes in 34 basic industries. Also covers complete line of comparators.

L379 \*W. A. Taylor & Co.

Air Pollution, Control.....The Bendix-Friez Aerovane system can be a big help to you in offsetting air pollution problems. The entire system can be used in dozens of plant applications. Details.

\*Friez Instrument Div.

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Sure are, if you're not keeping in touch with our advertisers. For they're your friends, offering help through new and better products and services. You can use our Index of Advertisers to keep in closer touch with these friendds and what they're doing for you.

<sup>\*</sup>From advertisement, this issue

- Controllers, Recording.....Dual temperature-humidity controls are rugged and have simplified designs. Partlow, the pioneer in mercury thermal controls, offers complete details of these controls in Condensed Catalog.

  361

  Partlow Corp.
- trois. Temperature, Local Mounted
  .... Each class covers a wide variety of adjustable ranges, on-off switch
  differentials & other characteristics
  which make it adaptable for many
  uses. Catalog Section No. 100.
  373 United Elec. Controls Co. Controls,
- es.....For pressure, vacuum or com-pound service. There are no gears or teeth to wear out. Cam wiping action keeps contact points clean & smooth. Provides complete information in Gage Catalog No. G-2. 291 "Helicoid Gage Div.
- Gages, Liquid Level....Presents valuable data on liquid level gages: refex; thru vision; tubular. Standard equipment in leading refineries and industrial plants all over the world. Request complete Catalog.

  R358

  \*Strahman Valves.
- Gages & Valves, Liquid Level.....Covers complete product line of armored gages and valves . . . for handling hazardous or valuable liquids without fear of leakage or breakage. Request detailed General Catalog.

  R404 \*Jerguson Gage & Valve Co.
- Indicators, pH..... Highlights features & component parts of Universal pH Indicator which make it adaptable & accurate for pH measurements in all types of plant & laboratory conditions. Catalog No. EH22-96.

  383A Leęds & Northrup Co.
- Indicators, Sight Flow.....Offer valuable features: inexpensive—prompt delivery; two sight-glass windows; flanged sight-glass covers; through-bolted construction; etc. Details in illustrated Pub. 11458.

  383B Fischer & Porter Co.
- Indicators, Sight Glass.....Visi-Flo line offers a trustworthy visible means of altering you as to rate of flow viscosity, color of liquids, clarity appurity of product. Sizes, styles, details in Bulletin No. F-6.
- Meters, Electricontact.....Now—explosion-proof—a new Niagara electricontact meter . . for automatically measuring and controlling liquids in hazardous atmospheres. Complete details in Bulletin No. 35.
  298 \*Buffalo Meter Co.
- Meters, Flow.....Describes F&P turbine flow meter—for precise flow rate measurement up to 100,000 pph at specific gravity 1.0 at ranges as high as 20:1—in 4 p. Illustrated Catalog 10-C-20 (Pub. 11392).

  383C Fischer & Porter Co.
- Meters, Purge.....Describes complete line of "Brooks-Mite" & "Sho-Rate" purge meters for convenient, dependable small flow indication. Includes application data, design details, etc. Bulletin No. 120.

  383D Brooks Rotameter Co.
- Meters, Purge . . . . Armored purge meter has been designed as a rugged, low-cost meter for purge fluids in refinery & other high pressure purge applications. Data & specifications in Catalog 10-A-45 (Pub. 11513).

  383E Fischer & Porter Co.
- Mueller Bridges.....Describes use of the precise Mueller Bridge as a laboratory standard of temperature measurement from —190 C to +500 C, with a limit of error of only 0.01 C. Details in Catalog EF22-33(1).

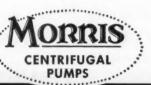
  383F Leeds & Northrup Co.
- Potentiometers, Wenner.....Details the application of the Wenner principle, for highly precise measurements of d-c potentials, to the thermocouple potentiometer and the standardizing potentiometer. Catalog EH22(2).

  383G Leeds & Northrup Co.

Remove 4 Bolts and there's the impeller!. no need to disconnect piping

MORRIS TYPE RX Sluvy Pump

Write for specifications, capacities, performance charts, and other helpful information. Ask for Bulletin 185.



Morris Type RX is the slurry pump whose impeller can be removed without disturbing the suction and discharge piping or the bearings! To get at the impeller and renewable shaft sleeve, you simply loosen four outside clamping bolts—slip them out of disc slots—take off the end cover. Impeller unscrews from shaft threads; shaft sleeve is removed through end cover opening.

At no point do you have to dismantle the piping. Lay-up time costs are less . . . pump is back in service quicker.

### Use the Morris Type RX in Your **Chemical Operations**

Morris Type RX is the product of nearly a century of experience in designing and building materials-handling pumps. It is specifically engineered to handle mixtures con-taining abrasive solids and chemicals in suspension, including acid slurries and sludges and slurries containing soda ash, ore concentrates, tailings, slag, etc.

> MORRIS MACHINE WORKS Baldwinsville, N. Y. **Branch Offices in Principal Cities**

<sup>•</sup> From advertisement, this issue

# IMPROVED CONDENSING and Cooling of Reflux



Niagara Aero Heat Exchangers at a Plant of the Heyden Chemical Corp.

# Get Better Control of Distillation Product

• Liquid or vapor temperatures are always held constant by the Niagara "Balanced Wet Bulb" control method of evaporatively cooling or condensing, which automatically varies the cooling effect proportionately to the load. The distillation product is therefore uniform throughout all changes in climatic conditions the year around; it is the same in the heat of summer as in the freezing cold of winter. Continuous maximum production is thus insured.

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NIAGARA AERO HEAT EXCHANGERS give sustained full capacity in cooling and condensing with no dependence on cooling water . . . eliminating problems of water supply, availability, temperature, or quality.

For full information write for Bulletin 120

## NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. CE , 405 Lexington Ave.

New York 17, N. Y.

District Engineers in Principal Cities of U.S. and Canada

#### LITERATURE . . .

- Receivers, Metagraphie.....Features a new degree of performing, flexibility, & ease of servicing in a pneumatic receiver. Bristol's line gives you 35 models to choose from. Request detailed Bulletin.
- Regulators. Pressure.....Announces development of a new hot air shutoff and pressure regulating valve...to control a jet engine anti-lcing system plus numerous other applications. Complete product Brochure.

  384A Hydro-Aire, Inc.
- Standard Conversion Tables.....Gives thermocouple temperature-millivolt equivalent. Temperatures expressed on Int'l Temperature Scale of 1948, electromotive force expressed in absolute units. Bulletin F7255.

  384B Conversion Tables.....Gives the property of the property
- Telemetering Systems, Supervisory Control
  ....A simplified method of multiplexing channels of information over 2
  wires. Describes features, system
  operation, advantages, etc. Catalog
  50-20 (Pub. 11516).
  384C Fischer Porter Co.
- Telephone Systems, Business.....How Glens Falls Insurance Company uses an interral, company-owned telephone system to economically reduce paperwork & speed operations is described in illustrated Report No. 108. 384D Automatic Elec. Sales Corp.
- Temperature Conversion Tables. . . . . Twocolor charts not only convert degrees
  Fahrenheit to Centigrade or vice
  versa from —400 to +4000 degrees,
  but also show temperature ranges of
  various sensing elements.
  384 E Thermo Elec. Co.
- Thermocouples......Compact, self-contained Conax Pressure Sealing Spring Loaded Thermocouples insure positive contact and fast response for thermal conductivity. For full details, request Bulletin 55-SL.

  384F Conax Corp.
- Transmitters.....The same Tel-O-Set transmitter can be used for temperature, absolute pressure or gage pressure . . in all ranges. For complete information on features, request Bulletin No. 7280.

  66-7

  \*Minneapolis-Honeywell.
- Transmitters, d/p Cell.....Simplicity is attained with the Foxboro type 13LA transmitter. Low in initial cost, little maintenance & easily converted in field for measurement of fluid flow. Bulletin 13-22.
- Transmitters, Force-Balance...... Describes Fischer & Porter's new ForceBalance Transmitter. Includes the
  numerous features, principles of
  operation, specifications, etc., in
  Catalog 50-30 (Pub. 11521).
  3846 Fischer & Porter Co.
- Transmitters, Pneumatic.....36 p., reference covers transmitters for measuring flow, pressure, level or density. Describe & illustrates 22 different models, gives hook-ups, ranges, performance data. Data Book 1004.

  \*Republic Flow Meters Co.
- Transmiters, Potentiometer.....Adaptable for the measurement of a wide variety of variables, & can be quickly modified for use with different electrical primary elements. Request Bulletin No. 98262.

  160-1 \*Taylor Instrument Co.

## Pipe, Fittings, Valves

Couplings.....Announces the availability
of a new booklet, "Amerigear Couplings....In action," which contains
a number of case histories of power
transmission problems which were
solved by unique coupling.
384H American Flexible Coupling Co.

<sup>\*</sup>From advertisement, this issue

These . . . are the products of





GEORGE G. RODGERS EQUIPMENT DIVISION

> **Built** to specifications in a complete range of sizes and capacities

- REACTORS
- **KETTLES** Stainless steel from 20 to 500 gallons
- . CONDENSERS and HEAT **EXCHANGERS** Stainless steel
- TANKS Stainless steel
- TOP ENTERING MIXERS 1/4 to 25 hp
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- PORTABLE MIXERS 14 to 5 ho
- POWDER MIXERS and BLENDERS Steel and stainless steel
- POWDER & PASTE FILLERS
- BALL and PEBBLE MILLS to 6' dia. x 8' long

FOR OTHER EQUIPMENT SEE OUR AD-VERTISEMENT ON PAGE 349 OF THIS

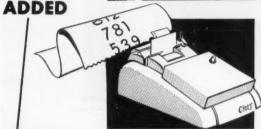
George G. Rodgers Division has had years of concentrated experience engineering and manufacturing fine equipment for many of the largest companies in the chemical process industries. We suggest you submit your specifications now, without obligation.



GEORGE G. RODGERS NEW EQUIPMENT DIVISION 2405 Third Ave., New York 51, N. Y. TEXAS OFFICE: 4101 San Jacinto St., Houston 4

## New REMOTE EIGHT RECORDS





Weight records can be transmitted to an add-ing machine and printed on the tape and inserted tickets with ability to totalize weight on the tape. Clary Model 9310 shown.

DIGITAL INDICATION



A completely new con-cept of weight indica-tion! From a remotely located scale, illumi-nated digital weight-indication is obtained.

TOLEDO ELECTRONIC WEIGHT CONTROL



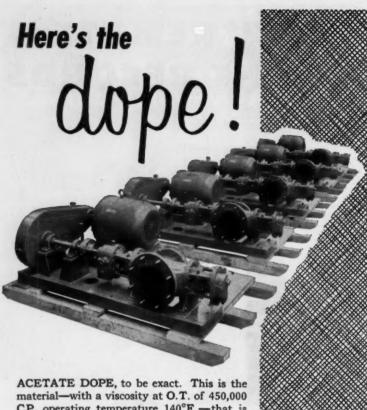
The weight indication passes through a Tole-do digital scanner and translator to provide an accurate signal that operates these remote devices to bring weights anywhere in the form most useful to you.

Through Toledo's new electronics system of remote data handling, weight data is no longer limited as to form, or close proximity to the point of origin. Weights can now go anywhere . . . and appear in tabulated, added, recorded, or digital-indicated form. This greatly

extends the capabilities of TOLEDOmation throughout production, and assures maximum cost control accuracy.

What is your weight control problem? Write for bulletins on new Toledo remote digital-indication and recording. Toledo Scale Co., Toledo 1, Ohio.

Headquarters for DO SCALES



CP, operating temperature 140°F.—that is being satisfactorily handled by these five

## WARREN-QUIMBY

#31/4 External Gear and Bearing Screw Pumps

together with seven more, all built for the Rome plant of

## Celanese Corporation of America

a leading producer of chemical fibers.

These pumps are of special design, with straight-through oversize connections on body; complete with flexible coupling, base, jack shaft, pillow blocks, sprockets, chain guard, and motor with sliding base. Built for variable pressures from 20 to 300 PSIG.

If you have difficult-to-handle liquids, unusual conditions or requirements, Warren-Quimby Engineering and Warren-Quimby pumps pay off.



## WARREN

WARREN STEAM PUMP COMPANY, INC.

Warren, Massachusetts

#### LITERATURE . . .

- Couplings.....Releases a revised catalog on Quick-Seal line of quick connect-disconnect hose couplings. Features cutaway views of coupling which reveal its unique design & construc-tion. "Quick-Seal Couplings." 386A Titeflex, Inc.
- Couplings, Clamp Type & Reusable.....

  Makes available reference covering
  a wide range of reusable & clamp
  type couplings & hose assemblies for
  high, medium & low pressure applications. Catalog No. 300.

  386B
- Fittings, Pipe..... Presents newest catalogue of stainless steel pipe fittings which shows all standard pipe fittings and flanges, fianged fittings, butt weld fittings, etc. Request fully illustrated Catalog No. 653.

  296a \*Camco Products
- Fittings, Stainless Steel.....Qulkupl
  Stainless Steel Fittings ... makes
  available Manual which covers the
  design, applications & limitations of
  revolutionary new type stainless fittings. Bulletin Q100.
  93a
  \*Cooper Alloy Corp.
- Flange Specifications......Company announces the development of a new Flange Specification table for ASA and MSS Flanges in a convenient, slide rule form. Pocket-size reference is available upon request.

  296b \*Camco Products.
- Hose Assemblies.....Presents a wide range of factory assembled high, medium and low pressure hose assem-blies for hydraulic, suction return and general applications, Request illus-trated Catalog No. 100. 3860 Anchor Coupling Co.
- Pipe & Fittings Glass.....Glass Pipe & fittings for full-scale production operations. Strenghtened by end-tempering & feature corrosion-resistance, non-contamination, etc. Catalogs non-contamination, etc. Catalogs EA-1 & EA-3 offer full data. 232-8a \*Corning Glass Wks.
- Pipe Installation, Glass.....Pipe is easy to install & low in installed cost compared with other corrosion-resistant materials. Available in 6 standard sizes from 1- to 6-inch. LD, inclusive. Installation Manual PE-3.

  282-3b \*Corning Glass Wks.
- Pipe, the p. Plastie.....Polyvinyl Chloride is the unparalleled material for plastic pipe. It's a high quality unplasticized-rigid pipe designed to do a better job than any other material. The full story in Bulletin 24. 88
- Tubes & Nozzles, Venturi.....Comprehensive & well-documented reference of interest to engineers dealing with measurement of liquid flow & its various ramifications. Advantages, construction, etc. Bulletin 100.

  386D Simplex Valve & Meter Co.
- Valves.....Line of steel valves feature dependable operation and low maintenance cost. Gate, globe and check types handle the most severe high-pressure, high temperature services. Full details in Catalog 20.

  172 \*Chapman Valve Mfg. Co.
- Valves, Butterfly. New comprehen-sive Catalog—in loose-leaf form—in-cludes a description of each valve, with specifications, layout drawings & dimensions of standard valves in each pressure rating, 48 p.
  400 S. Morgan Smith Co.
- Valves, Corrosion-Resistant..... Hard-boiled acids can't corrode Aloyco "Hastelloy" valves. These valves undergo a special annealing process that imparts better machining quali-ties. Request Bulletin 10. 83 \*Alloy Steel Prods. Co.

<sup>•</sup> From advertisement, this issue





## Check these Special features

RUBBER TREADS a wide choice of treads swited to all types of floors, including Durnelloprene oil, water and chemical resistant treads, make Darsell Casters and Wheels highly adapted to rough wage.

RUST-PROOFED by zinc ploting, Darnell Coaters give longer, care-free life wherever water, steam and corroding chemicals are freely used.

STRING GUARDS Even though string and revellings may wind around the hub, these string guards insure easy rolling at

LUBRICATION all svivel and wheel bearings are factory packed with a high quality greese that "stands up" under attack by host and water. Quick greese-gan habitestian newless easy maintenance.



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# Westinghouse...<u>The</u> Unit Heater for General Purpose and Heavy Duty Industrial Heating

- ★ These rugged units available in 24 sizes, 8 coil selections, 150 ratings—from 100,000 to 2,500,000 BTU/hr., capacities from 2000 to 25,000 CFM each.
- ★ GENERAL PURPOSE HEATER... For manufacturing areas, warehouses, garages, commercial buildings —with standard non-ferrous heating coils.
- ★ HEAVY-DUTY HEATER
  ...For continuous-duty highpressure systems, or industrial process work—with
  wrought iron heating coils.
- ★ FOR APPLICATION SERVICE... Call your nearest Sturtevant Sales Engineer or write Westinghouse Electric Corporation, Hyde Park, Boston 36, Mass.... ask for Booklet B-5188.

Industry's Most Complete Line For:

Heating & Ventilating Industrial Processes

Cooling & Dehumidifying Electronic Air Cleaning

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When ready to order, how about checking with us here at DURALOY? For more than thirty years we have specialized in high-alloy castings. In fact, we were among the first to produce static castings and the first to produce centrifugal castings. We are old hands at producing castings alloyed to fit each specific requirement and to finish them to any extent desired.

Melt, castings and finishing are carefully controlled and quality tested by our staff of metallurgists, chemists, X-ray and gamma-ray technicians. If you would like more preliminary information, send for Bulletin No. 3150-G.



#### LITERATURE . . .

Valves, Diaphragm.....Features; handle viscous materials without restriction or stoppage; minimum pressure drop; rodding or brushing without removing bonnet & no damage to body linings, etc. See Bulletin.

8 Grinnell Co.

Valves & Fittings, Drop Forged Steel
.....400 p. book describes complete
line of drop forged steel valves, fittings, & fianges for oil, steam, water,
air, gas & refrigeration services.
Catalog No. F-9.
174

Valves, Gate.....Walworth's iron body gate valves with screwed or flanged ends reduce fluid turbulence to a minimum. Valves have eight outstanding features. For complete information, request Bulletin 106.

78 \*Walworth Co.

Valves, Gate, Bronze.....Announces release of a new descriptive Folder describing 40 patterns in complete line of bronze Gates. You will find the valve you need, with details of design and construction. 163 \*\*Jenkins Bros.

Valves, Plug.....No funnel action . . . because both ACF regular round & ACF rectangular port valves have port areas at least equal to the pipe itself. For complete details of features, see Catalog No. 5.

101

\*ACF Industries.

Valves, Porcelain.....Company makes available detailed literature covering the features and advantages of porcelain valves. Bulletin includes complete description, characteristics and specifications of product line. 155 \*Lapp Insulator Co.

## **Process Equipment**

Agitating Equipment.....Use Nettco Flomix to combine liquids & solids as they flow through a pipe line. For complete information, company makes available bulletins & data. Nos. 551 & 532. 32 \*New England Tank & Tower.

Blenders, Twin Shell.....In plant after plant ... the Patterson-Kelley twin shell blender does the job better, faster, and lasts longer. For complete information on product line request descriptive Catalog 13. 48 \*Patterson-Kelley Co.

Centrifuges.....High speed dehydrating centrifuge offers precise external control of variations in flow rate, crystal size & slurry concentration & permits intermediate treatment of crystals. Bulletin No. 1257.

Chlorinators.....Describes the new F&P Figure 1050A Chlorinator ... a vacuum-type solution-feed gas chlorinator for capacities from 0.1 lbs. of chlorine gas per 24 hrs. to 1000 lbs. per 24 hrs. Catalog 70-10.

388A Fischer & Porter Co.

Classifiers . . . . All classifiers (Rake Type, Spiral, Hydro) are designed to efficiently separate fine particles in specific applications. For complete information on company's line, request Bulletin C5C-B. 369C Denver Equipment Co.

Collectors, Multi-Wash.....For the efficient removal of air-borne contamination (dust, fumes, vapors, acid gases and odors) and recovery of product thru multiple washing action. Details in Bulletin No. 610. BL306 \*\*Claude B. Schneible Co.

Crushers, Jaw.....Cast steel frame, manganese jaw & cheek plates. Large diameter shafts reduce shaft deflection & thus increase life of heavyduty, oversize roller bearings in bumper. Bulletin No. C12-B12. 369d \*Denver Equipment Co.

<sup>\*</sup>From advertisement, this issue

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Sure are, if you're not keeping in touch with our advertisers. For they're your friends, offering help through new and better products and services. You can use our Index of Advertisers to keep in closer touch with these friends and what they're doing for you.

- Dissociators, Ammonia.....Illustrated, 12 p. offers valuable information: typical uses of dissociated ammonia; description of dissociator economy; advantages; sizes-capacities; users of equipment; etc. Bulletin B-52.

  \*Drever Co.
- Dryers.....Iectro-dryers can dry air & gases in volume to dewpoints below —100°F—can, drop relative humidity lower than 10%. Booklet describes machines & how various industries use them to gain efficiency.

  168 Pittsburgh Lectrodryer Corp.
- Dryers.....Available in several types:
  direct heat, indirect heat, and steam
  tube. Let Deco engineers help solve
  your drying problem—no dryer problem too small or too large. Details
  in Bulletin No. D4-B2.
  369j Denver Equipment Co.
- Dryers.....Describes & illustrates the packaged Turbo-Dryer for small production, pilot plant & experimental drying operations. Includes outstanding advantages & features, construction data, etc. Bulletin 2504.

  389A Wyssmont Co.
- Dryers, Botary.....The Davenport rotary hot air dryer is of stainless steel construction. Dryer is installed in one of the large processing plants, drying wheat gluten. For complete details, request Catalog A.

  BL377 \*Davenport Mach. & Foundry.
- Dryers, Rotary .... Deliver top production, exacting performance, greater profits. Tells how Standard-Hersey has aided manufacturers throughout the world in solving their dryer problems in illustrated, 12 p. 36
- Drying, Gases..... The Hydryer dries all gas without loss, purging is eliminated, etc. Bulletin tells you the many ways the Pritchard Hydryers are used in the chemical industry. Request your copy, No. 16.0.081.

  304-5

  \*J. F. Pritchard & Co.
- Dust Control.....Sly flat bag dust filters get all the dust. Pioneers and leaders in industrial dust control, they have a complete range of equipment for all process operations. Request Bulletins.

  \*W. W. Sly Mfg.
- Pust Control.....Pangborn engineers help solve your dust problems—line of wet or dry dust collectors can save time, trouble & money. See how varied industries are benefited in "Out of the Realm of Dust."

  312 \*Pangborn Corp.
- Dust Control.....Analyses of how dust control equipment solves the problem of recovering valuable dusts—or controlling harmful dusts. Makes available Bulletin covering complete technical information. No. 800. 38 Dracco Corp.
- Dust Filters.....Read why the Hersey reverse jet principle is the most significant improvement in dust filter design in more than half-a-century, in "Reverse Jet Dust Filter Facty," Bulletin 559.

## SPARINGLY

e make it a rule not to recommend tantalum unless it is the only right material for a particular process. And when we design tantalum equipment, we use it sparingly—an easy task in most instances because tantalum's strength and excellent heat transfer qualities make for minimum bulk. Where other materials of construction can be used in conjunction with tantalum, we specify them.

All this is an effort—and so far, it has been a successful effort—to lower processing costs. The benefits of tantalum's complete immunity (not mere resistance) to most corrosive reagents are now obtainable at final operating costs far less than the costs of processing without tantalum.

Why not discuss your corrosion problem with Fansteel engineers for a practical, unbiased recommendation? There is no obligation, and consultations are kept in strictest confidence.

USE TANTALUM WITH ECONOMY for most acid solutions and corrosive gases or vapors, except HF, strong alkalis or substances containing free SO<sub>3</sub>.



Write for free book, TANTALUM in Chemistry

FANSTEEL METALLURGICAL CORPORATION
NORTH CHICAGO, ILLINOIS, U.S.A.

G561A

TANTALUM...
We have it
in abundance
We sell it

<sup>\*</sup>From advertisement, this issue

Write

# for Catalogs 73 and 77 for Complete Data on BALL MILLS · PEBBLE MILLS JAR MILLS · JAR ROLLERS



If you carry on pulverizing, wet or dry grinding and/or mixing of chemicals, drugs, cosmetics, printing inks, coatings, paints, lacquers, minerals, etc., you will find these catalogs useful working tools for your files. They give complete details on the Abbé Engineering series of mills for every range of work from small batch jobs to full scale plant production.

These are the mills that have stood the test of time. The ability of Abbé Engineering to help plan their use, as a result of long years of experience with these mills, is a vitally important factor. Sturdy construction and sound design insure long service life and the lowest over-all operating costs.

WRITE FOR CATALOGS TODAY!

ABBÉ ENGINEERING COMPANY 50 Church Street • New York 7, N. Y.

#### LITERATURE . . .

- Evaporators.....Complete Swenson Catalogue contains full information on long-tube vertical evaporator, spray dryers, crystallizers, forced circulation evaporators & recovery equipment for pulp mills. 20-1a \*Swenson Evaporator Co.
- Filter Fabrics..... The right fabric adds efficiency to continuous operation. Announces availability of a fully Illustrated booklet, "Filter Fabric Facts," describing filter fabric development and application.

  84 \*Wellington Sears
- Filters, Disc . . . . Special, patented design of segments in filters use both gravity & vacuum to give a drier filter cake. Drainage is complete & positive with no blow-back. Details contained in Bulletin F9-B2.

  369f \*Denver Equipment Co.
- Filters, Horizontal Vacuum ..... Bird-Prayon continuous, rotary, horizontal vacuum filter combines: super efficient multi-stage washing; high operating efficiency; low operating cost. Bulletin No. BP-2-55-5M. 6 \*Bird Mach. Co.
- Filters, Liquid.....12 p. offers specifications, engineering & performance data, photos & descriptions of recommended types of filter media, check list of liquids that can be filtered, etc. Bulletin D-1L. \*Dollinger Corp.
- Filtration.....Company makes available valuable bulletins: B-12, General Filtration; C-22, Use in Paint, Varnish & polishes: F-52. Use in Paper & Pulp; F-552; & Dry Cleaning Plants Manual.

  14 \*Dicalite Div.
- Flakers.....Stokes flaker replaces batch method in the processing of moth-killing chemical. Full details of laboratory and advisory service for solution of production problems are covered in Buletin No. 640.

  100 \*F. J. Stokes Mach. Co.
- Grinding Equipment, Valve.....Describes the all-new Dexter Power Driven Valve Grinding equipment... designed to grind the seat of any globe or gate type valve regardless of valve material hardness. 6 p. 390A Leavitt Mach. Co.
- Kilns, Rotary.....Efficient thermo-processing of products. Used in the production of lime, bauxite, cement, sodium silicate. alumina. etc. Complete data on design features offered in illustrated Builetin 115. 18 \*Traylor Engrg. & Mfg. Co.
- Mills, Ball.....A steel-head ball mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Bulletin No. B2-B13.

  369b \*Denver Equipment Co.
- Mills, Ball & Pebble.....Valuable references give complete details on the Abbé Engineering series of mills for every range of work from small batch jobs to full scale plant production. Catalogs Nos. 73 & 77.

  390a \*Abbé Engrg. Co.
- Mills, Hammer.....Williams heavy duty hammer mills: increase your output; improve product quality; reduce your cost-per-ton. For complete details of features and advantages, request complete product reference.

  61a \*Williams Patent Crusher.
- Mills, Roller.....When making any kind of powdered pigments or commercial fillers, use of High-Side Roller Mill with Whizzer Separation offers important production advantages. See Catalog No. 79.

  280 \*Combustion Engrg.
- Mixers..... Eastern's mixers are designed to meet the needs of today's chemical and industrial processes. Covers portable mixers, top and side entering mixers, turbine mixers, etc. in Catalog Series No. 26.

  401

  \*Eastern Industries.

<sup>\*</sup> From advertisement, this issue

A WIDE RANGE OF ACCURATELY REDUCED PRESSURES

with **DAVIS** 



PRESSURE REGULATORS

Here's positive, accurate pressure reduction in a range from 1 to 100 pounds. The Davis No. 13 is ideal for control of unit heaters, steam kettles, vulcanizers, presses, sterilizers and other small equipment. Tight closing ... non-sticking feature assures long dependable operation and minimum maintenance, easy servicing. Built-in strainer for easy cleaning. Install Davis pressure regulators for least in maintenance, tops in dependability.

- BUILT-IN STRAINER for easy cleaning, positive protection!
- ORIFICE TYPE VALVE for tightclosing, non-sticking operation.
- BRONZE, SEMI-STEEL, OR STEEL BODY—special alloy frim available.
- COMPLETE RANGE OF SIZES— %, ½, ¼, 1, 1½, 1½ and 2 inches.

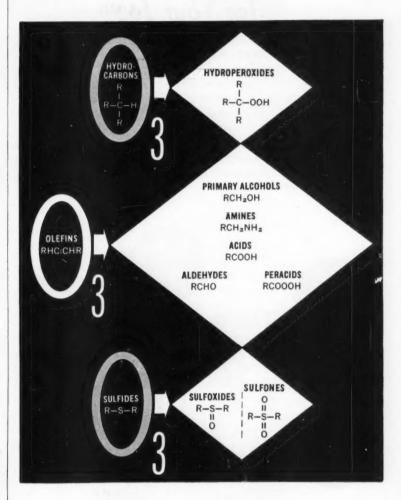


SEND FOR NEW CATALOG No. 200 — Features pressure regulators, altitude valves, pump governors, emergency valves and felief valves.

Davis REGULATOR COMPANY

2530 So Washtenew + Chicago S. Illinois

## new low cost synthesis methods through ozone



OZONE is the versatile new tool for low cost organic synthesis which features specific, high yield reactions with proven dependability and the utmost in convenience. Information and equipment from laboratory size to tonnage plants are available from

RESEARCH DEVELOPMENT WELSBACH OZONE

LABORATORY UNITS PLANT INSTALLATIONS

THE WELSBACH CORPORATION—DZONE PROCESSES DIVISION—1500 WALNUT ST., PHILADELPHIA 2, PA

# It's Our Job to Provide the RIGHT FILTER PRESS

## for Your Job

Take a closer look at the job you want your filter to do, and you'll find in the Shriver Filter Press economy and versatility of performance unmatched by any other type of filter. Whether you filter for cake recovery or for crystal clarity of liquid, or combine these operations with washing, extraction or drying, in the Shriver Filter Press you get multiple functions in a single, simple unit, easy to operate at minimum cost.



Wash Extract Redissolve Melt









# Shriver

Shriver Filter Presses are made in all types and sizes for use with any filter media, to operate at any pressure and temperature. Catalog 55 tells how. Write for a copy.

T. Shriver & Company, Inc.

Filters • Filter Media

Diaphragm Pumps

802 Hamilton Street . Harrison, N. J.

#### LITERATURE . . .

- Mixers.....Company makes available Confidential Mixing Data Sheet. Helpful checklist enables you to develop a complete technical description of agritation required for your process, quickly & easily. No. B-107.

  123a \*Mixing Equipment Co.
- Mixers.....Describes Super Agitators & Mixers. Patented standpipe around propeller shaft assures positive agitation & circulation. Patented wearing plate prevents sand-up on shut-down. Bulletin No. A2-B4.
  369a \*Denver Equipment Co.
- Mixers, Paste....."Pony" paste mixer combines mixing advantages of sigma blade, or heavy duty, paste mixer with versatility & ease of cleaning of a change can mixer. Illustrated Folder offers full details.

  R306 \*Herman Hockmeyer & Co.
- Mixers, Portable..... Use in industry reduces costs, saves time, labor and secures better and more refined products. Catalog includes data on construction, dimensions, specifications, etc. 28 p. No. B-108.

  \*Mixing Equipment Co.
- Mixers, Side Entering.....Furnishes detailed information on features, typical applications, mechanical design, maintenance, shaft seals, methods of installation, etc., in completely illustrated Catalog B-104.

  \*Mixing Equipment Co.
- Mixers, Top Entering....Illustrated and detailed 32 p. Catalog includes advantages, typical installations, mechanical description, construction information, dimensions and selection tables, etc. Catalog No. B-102.

  123d "Mixing Equipment Co.
- Mixers, Top Entering.....Makes available pertinent information on topentering mixers (propeller type)
  ... for closed tanks, pressure & vacuum ... for open & loose-covered tanks. Data in Catalog No. B-103.

  \*Mixing Equipment Co.
- Mixers, Vertical.....Permit the mixing of a limited amount of liquids with dry ingredients. Occupy little floor space & have low hp. requirements. Can be adapted to meet your special needs. Information available.

  41a \*Sprout-Waldron
- Presses, Filter.....Offer numerous features: lowest cost per sq. ft. of filtering area; produce perfect clarity of filtrate; can be used in decolorizing—deodorizing; etc. Request illustrated Catalog No. 55. 392a \*T. Shriver & Co.
- Process Equipment.....Describes entire company line—conical mills, single & double-shell rotary dryers, automatic backwash sand filters, thickeners-clarifiers, constant-weight feeders, etc. Catalog 100-A-11.

  310a \*Hardinge Co.
- Roll-Setting.....Hydra-Set is a unique hydraulic roll-setting device that takes all guesswork out of roll settings. Comes as optional equipment on new mills or as field conversion kit. Spec. Sheet No. 1-400 R.M. 295
- Separators, Air.....40 to 400 mesh output upped as much as 300%. Sizes range from 3 to 18 ft. in diameter. Company makes available product bulletins on separators as well as other equipment.

  27a \*Sturtevant Mill Co.
- Strainers, Fine Screen.....Yarway fine screen strainers are available in iron or steel with rust-resistant finish, also bronze, stainless steel and aluminum. Full data on features in Strainer Bulletin S-204.

  \*Yarnall-Waring Co.
- Tables, Concentration . . . . Separate materials into bands & handle coarsest sands with excellent results. Ideal for separation of groups of particles having similar range of specific gravities, Bulletin Ti-B3.

  369h \*Denver Equipment Co.

\*

<sup>•</sup> From advertisement, this issue





every kind

in stock

#### FOR IMMEDIATE SHIPMENT

CARBON, ALLOY AND STAINLESS STEELS
BARS • STRUCTURALS • PLATES • TUBING
SHEETS & STRIP • REINFORCING STEELS
ALSO MACHINERY & TOOLS • PLASTIC PIPE
INDUSTRIAL PLASTIC • BABBITT METAL, ETC.



Plants at : New York • Boston • Philodelphia Charlotte, N. C. • Cincinnati • Cleveland Detroit • Pittsburgh • Buffalo • Chicago Milwaukee • St. Louis • Los Angeles Son Francisco • Spokane • Seattle

### **Pumping Progress Report**

FOR CHEMICAL ENGINEERS

An advertisement prepared by the Aldrich Pump Co. Member of Hydraulic Institute, U.S.A.

UREA PRODUCTION, like many other chemical processes,
presents difficult pumping problems. Urea
slurry is both corrosive and erosive. Either
condition can cause serious operational headaches; together they spell trouble for both
design and maintenance engineers.

PUMPING UREA SLURRY was the problem given to the

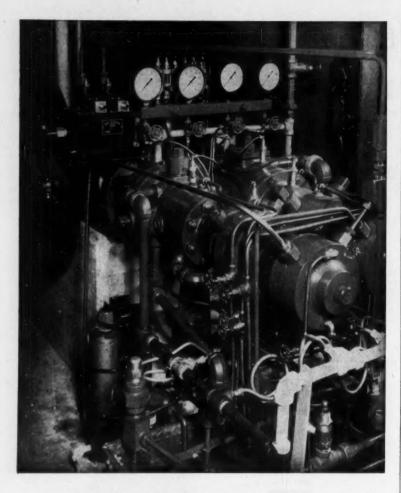
Aldrich Pump Company Engineers by one of the
foremost producers of urea. Our solution was
effective. We recommended...

A 6" STROKE DIRECT FLOW TRIPLEX with several material of construction modifications. Porcelain plungers were used instead of the usual hardened alloy steel. The entire fluid-end was made of Hastelloy B, but Direct Flow Fluid-End construction was maintained to give minimum cost of parts replacement in the event of unavoidable corrosion or erosion damage.

ALDRICH DIRECT FLOW DESIGN offers many advantages to reciprocating pump users. Two right angle turns are eliminated in the fluid-end block. The liquid being pumped travels in a straight line, on a horizontal plane, from the suction to the discharge manifold. Reduced space between valves results in higher volumetric efficiency and extra close valve clearance.

SECTIONALIZED FLUID—ENDS also afford greater economies of maintenance. Valves can be removed for inspection or replacement without special tools or equipment. Individual sections of the fluid—end can be replaced at a fraction of the cost of conventional type fluid—ends.

DATA SHEET 67A illustrates and describes the Aldrich
6" Stroke Direct Flow Pump Series. This
Series includes Triplex, Quintuplex, Septuplex
and Nonuplex Pumps, ranging in power from 300
to 900 hp. Aldrich Engineers are available
to help you solve your tough pumping problems.
Address your request to: The Aldrich Pump
Company, 3 Gordon Street, Allentown, Pa.



Six stage Norwalk compressor, used by a large university, compresses hydrogen to 25,000 pound pressure

Horizontal duplex construction makes this compressor compact and sturdy. Frames with taper roller main bearings, reversible ring plate valves, force feed lubrication, generous intercooler coils are some of the features (common to all Norwalk compressors) that make for efficiency and long-term economy. Descriptive catalog forwarded promptly on request.



#### NORWALK COMPANY, INC.

SOUTH NORWALK, CONNECTICUT

makers of high pressure compressors for 91 years: 1864—1955

#### LITERATURE . . .

Vessels, High Pressure.....Cole can build you the kind of high-pressure tanks or vessels you require... any size, any shape, any metal. For com-plete product information, request copy of catalog, "Tank Talk." BL311

Wire Cloth......80 p. catalog describes company's facilities for fabricating wire cloth parts. Includes wire cloth parts for screening, filtering and special uses. Also provides helpful metallurgical information. 364 \*Cambridge Wire Cloth Co.

Wire Cloth.....Oldest manufacturer of precision wire cloth woven of specified metals for every industrial filtering, straining & sizing operation. Data Book aids in selecting & ordering wire cloth & Screen.

287 \*Ludlow-Saylor Wire Cloth Co.

#### Pumps, Blowers, Compressors

Compressors.....Reversible ring plate valves, force feed lubrication, sealing type piston rings, generous intercooler coils are features which make for efficiency and long-Descriptive Catalog. long-term economy.

Compressors .....Add compressed air power efficiently with the Joy WG-9. Features: full force feed lubrication; "dual-cushion" valves; anti-friction main bearing; etc. Information in Bulletin 22-11.

\*Joy Mfg. Co.

Compressors, Centrifugal.....Offers a complete line of centrifugals for gas compression and refrigeration—up to 10,000 horsepower in a single unit. Details in booklet, "Centrifugal Compressors for Industry."
92 \*Carrier Corp.

Compressors & Engines.....Available in a range of sizes from 100 to 5000 hp. Cooper-Bessemer engines & compres-sors are ready to meet your exact requirements. New product bulletins offer the latest information. 162 \*Cooper-Bessemer Corp.

Fans.....Makes available a fully illustrated reference describing the newly redesigned, improved line of "Chicago" Axial Airfoil Fans. Explains their function and design in detail. Request Bulletin AA-101.

394A Chicago Blower Corp.

Pumps.....16 p. reference illustrates and describes products from the com-pany's full line of vacuum and liquid pumps, air brake equipment, and hydraulic motors, controls and pumps. Request Brochure No. 1102. 394B New York Air Brake Co.

Pumps.....Vanton's "flex-i-liner" is the answer to the problem of pumping ferric chloride. It operates equally well in either direction, a reversing switch on the motor provides a quick direction change. Catalog VP55.

93b \*Cooper Alloy Corp.

Pumps.....Nagle pumps handle slurry against 400' head. Design of the type "T" pump provides quick slip-page seal adjustment, etc. Bullt for gritty, abusive jobs. Complete information in Catalog No. 5206. BL309 •Nagle Pumps

#### Now turn to the back . . .

Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the products.

\*From advertisement, this issue

#### COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

MORE COMPACT THAN EVER . .



P-952-A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

#### NATIONAL AIROIL

## FUEL OIL PUMPING AND HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return, and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40 — very interesting and informative.

OIL BURNER and GAS BURNERS for Industrial power, process and heating purposes STEAM ATOMIZING OIL BURNERS SLUDGE BURNERS, Steam Atomizing MOTOR-DRIVEN ROTARY OIL BURNERS MECHANICAL PRESSURE ATOMIZING OIL BURNERS DUAL STAGE, Combining Steam and

DUAL STAGE. Combining Steam and Mechanical Atomization LOW AIR PRESSURE OIL BURNERS AUTOMATIC OIL BURNERS, for small process furnaces and heating plants GAS BURNERS COMBINATION GAS & OIL BURNERS FUEL OIL PUMPING and HEATING UNITS FURNACE RELIEF DOOPS

FURNACE RELIEF DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES



1235 E. Sedgley Avenue, Philadelphia 34, Pa. Southwestern Division: 2512 South Boulevard, Houston 6, Texas



### Arnold O. Beckman MODEL F3 OXYGEN ANALYZER

with the meter on the door

New convenience has been built into the well-known F3 Oxygen Analyzer...a meter on the door provides readings at the sampling point for making calibration checks, process changes, etc. In fact, complete analyzing, calibrating and indicating components are now incorporated into the single F3 unit—at no extra cost!

#### Use The Model F3

ON OPERATIONS LIKE THESE...TO MAKE SAVINGS LIKE THESE



#### COMBUSTION

Boilers, Kilns, Direct-Fired Heaters, Stills, etc. Higher combustion efficiencies, at lower fuel costs

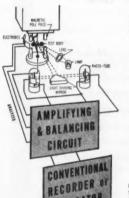
#### PROCESSING

Air Liquifraction . . . Processing Butadiene, Acetylene and Similar Gases Better product quality with minimum oxygen or air contamination

#### **PLANT SAFETY**

Hydrogenation, Hydrofining, Gas Compressors, Sulfur Grinding, etc. Control explosive atmospheres, reduce fire risks, minimize plant and personnel hazards

#### Unique Operating Principle



The various applications highlighted above are only a few of the many ways Arnold O. Beckman Oxygen Analyzers—industry's great new profit builders—are being used by progressive operators to boost profits, cut costs.

lyzers—industry's great new profit builders—are being used by progressive operators to boost profits, cut costs.

These are the only oxygen analyzers that continuously measure process streams by an advanced magnetic principle that provides direct physical measurement of the oxygen itself—not of some secondary relationship.

oxygen itself—not of some secondary relationship.

Heart of the unit, as illustrated, is a dumbbell-shaped test body suspended in a magnetic field. Sample gas surrounding this test body causes it to rotate in the field, depending upon the oxygen content of the gas. The movement of a light beam, reflected by a small mirror on the test body, is measured by simple electronic circuits... and the result indicated directly on a conventional recorder or indicator. It's simple, positive, accurate!

No chemicals—filaments—catalysts cams—complicated mechanical parts!

FEATURES OF THE F3

Many Ranges: Full scale ranges of 0-5%,0-10%,0-15% O₂ and higher. Accuracy: 1% of full scale.

Multi-Ranges: Any instrument may be supplied with two or more ranges.

Note: For ranges narrower than 0-5% O<sub>2</sub> ask about the Model G2. Send for Helpful Free Literature which describes this unique operating principle in detail—explains its many advantages and applications. When writing, outline your particular operations—we'll gladly supply specific information.

Ask For Data File 16Y-105

old O. Beckman

Instruments for Science and Industry

SOUTH PASADENA, CALIFORNIA



Continuous sheet of sticky, dewatered hydrogel, neatly lifted from filter drum at top right, is carried by strings to discharge roll, falls to conveyor.

## YOU CAN PUT ALMOST ANY FILTER CAKE ON FEInc STRINGS

The FEinc String Discharge Filter . . . the original rotary vacuum string filter . . . easily handles thin soupy slimes, heavy sludges, coarse granules or fibres, sticky gels . . . almost any type of cake. The strings pick the cloth clean. The cloth does not smear and plug . . . you get more filtration per foot with FEinc. Blow-back is completely unnecessary, hence there's no wire winding. There's no scraping wear, hence cloths last two to five times longer. Cloth changing takes less time, too. The strings actually help. String life is excellent.

These are just a few of the reasons why, in a surprising number of cases, this FEinc is the most economical of all filters for the "easy" jobs as well as the tough ones.

The string filter is only one of many types of continuous filters now made by FEinc . . . backed by 35 years of experience . . . with proved ability to deliver tailor-made filters at no more than standard costs. Write or phone for details.



Ask for FREE technical bulletins

#### Filtration Engineers, Inc.

CUSTOM DESIGNERS AND MANUFACTURERS OF ALL TYPES OF CONTINUOUS FILTRATION EQUIPMENT FEinc

155 ORATON STREET . NEWARK 4, N. J.

#### LITERATURE . . .

- Pamps.....Information on the number of rings, depth of box, type of packing... chemical & physical properties of fluid being pumped, speed of shaft & other usable facts, in Pump Bulletin No. S-147.

  R395

  \*Taber Pump Co.
- Pumps.....Capacities to 150 gpm & heads to 600 ft. Apco is the highest development of the turbine-type pump. These pumps are suited to "1001" duties. For full information, request Bulletin 111 & Catalog M.

  TL311 \*New York Air Brake Co.

13

-

- Pumps.....For most efficient, carefree service in moving liquids, you can depend on Frederick SSV pumps. Constructed of metals to meet your requirements, Offers Bulletin which describes these pumps, No. 107. L365 \*Frederick Iron & Steel
- Pumps, Acid.....On most difficult pumping jobs... dependable highly efficient pumps deliver continuous trouble-free performance on 'round-the-clock schedules wherever they are installed. Full details.

  97

  \*A. R. Wilfley & Sons.
- Pumps, Centrifugal . . . . . Specially built centrifugal pumps are used to handle abrasive & corrosive sludges, slimes & slurries. They give maximum pumping service for years. Descriptive Bulletins available on request.

  380 \*McNally Pittsburg Mfg. Corp.
- Pumps, Centrifugal.....Designed for efficient liquid transmission & low cost maintenance, pumps offer many exclusive features. Furnishes engineering data on all types of pump applications in Catalog No. 253.

  169 Tri-Clover Div.
- Pumps, Centrifugal.....New paper stock & industrial liquids pump features a diverging type impeller which enables it to handle liquids containing high concentrations of solids, air & gases. Bulletin No. 7325.

  396A Ingersoil-Rand Co.
- Pumps, Centrifugal, Scalless.....New design features of leakproof "canned" pumps extend applications & slash price 20-25%. Offers mass production techniques & little maintenance. Request Bulletin No. 1030.

  35 "Chempump Corp.
- Pumps, Chemical Oll-Lubricated.....

  Recommended for pumping liquors, corrosive materials and solutions in the most used ratings to 3500 gpm, heads to 400 feet for liquids to 550 F. Request Bulletin 52Bf638,

  273 \*Allis-Chalmers Mfg. Co.
- Pumps, High Vacuum.....Describes Kinney high vacuum pumps . . . for every industrial and scientific application. Product line is the largest of any in the world. For complete information, request Catalogue 425, 269 \*Kinney Mfg. Div.
- Pumps, Piston-Diaphragm.....For controlled-volume pumping of fluids. Flow-charts, typical applications, description & specifications of models of various capacities & constructions in Bulletin No. 500.

  43

  \*Lapp Insulator Co.
- Pumps, Process....De Laval CPO process pumps handle numerous liquids: salt brine; sea water; caustic solution; soap solutions: etc. Canacities to 2000 gpm—heads to 200 ft. Details in Bulletin No. 1125-B.

  168 \*De Laval Steam Turbine Co.
- Pumps, Slurry.....Slurry pumps handle extremely thick slurries with high specific gravities. Provide long operating life with little or no maintenance. Covers features and selection data in Bulletin No. 185. 383 \*Morris Mach. Wks.
- Pumps, Submersible Booster .....Bulletin describes new submersible booster pump for industrial and municipal use, Includes data on pump and motor features, specifications, selection tables, applications, etc. 196B Layne & Bowler Pump Co.

\* From advertisement, this issue

Pumps, Sump......New bulletin helps to select the most efficient unit for a specific sump job. Contents: construction features, information on Single & Duplex types etc. Request copy of Bulletin No. 4500. R313 \*Deming Co.

#### Services & Processes

- Apparel, Industrial....."Asbestos Safety Clothing" describes in detail the various articles of safety apparel: asbestos suits, helmets, aprons, leggings, overshoes, Wearbestos gloves and mittens, etc. 12 p. 397A
- Atomic Energy Industry......44 p. "The Atom in Our Hands" describes unique process used to separate billions of uranium atoms to capture rare type of uranium 235 needed for atomic energy operations. Illustrated.

  397B Union Carbide & Carbon Corp.
- Filter Aids.....For clearest filtration, use Solka-Floc filter aid. 99.5% chemically pure cellulose, Solka-Floc comes in a wide range of grades to meet your specific needs. Request literature and samples.
- Fire Extinguishers..... Efficient, dependable & superior in design, new expanded line of Kidde extinguishers now make it easier for you to choose the right extinguisher for every fire hazard. P-8 Catalog.

  \*Walter Kidde & Co.
- Flotation.....More large plants are installing "Sub-A's" for entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, simplified continuous operating. Bulletin No. F16-B81.

  369g \*Denver Equipment Co.
- Laboratory Equipment.....Fully illustrated, 16 p. covers variety of laboratory equipment: mobile air conditioners; liquid coolers; flexible heating tapes; stop watches; etc. Apparatus Digest No. 3.

  3970 A. Daigger & Co.
- Laboratory Equipment.....Batch and continuous test models of crushers, screens, ball mills, pulverizers, rod mills, classifiers, agitators and mixers, pulp distributors, feeders, etc. Data in Bulletin LG3-B10.

  3691 \*Denver Equipment Co.
- Plant Sites.....Data on raw materials, transportation, power and fuel, markets, labor, facilities, sites, community services, laws and regulations, etc. Also includes physical map. "Industrial Location Services."

  171 \*N. Y. State Dept. of Commerce.
- Plants, Crushing.....Describes Type
  "J" Portable & Semi-Portable Crushing Plants—rugged, self-contained
  units that can be moved to any crushing job & made ready for operation
  quickly, Bulletin C12-B16,
  397D Denver Equipment Co.
- P-W supports for cable & Tubing.....
  P-W supports for cable and tubing have been engineered to cut costs from drafting and estimating tables to the finished job. Full details in Bulletins Nos. 855 and 955-D.

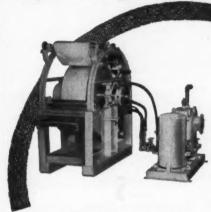
  397E
  P-W Industries.
- Vents, Non-Conservation.....Storage tank installation at eastern by-product benzol plant combines: maximum airflow capacities; positive fire protection; low-cost maintenance. Request "Venting Fundamentals."

  R309 \*\*Protectoseal Co.
- Waste Water & Conservation Systems
  .....Makes available information
  literature describing the Gale interceptor, separator & waste water treatment systems . . . economical in construction & maintenance cost.
  397F Gale Separator Co.

\*From advertisement, this issue

## NOV 2 FEInc

## PILOT PLANT FILTERS help reduce your development costs



Here's a low-cost way to work the kinks out of your filtration problems before you scale up.

If it looks like a job for a rotary drum vacuum filter, ask for the FEinc String-or-Scraper Discharge Filter. It's furnished with both the FEinc String Discharge and the FEinc Scraper Discharge mechanisms. You can try first one, then the other. It also has the FEinc submergence washing and compression dewatering mechanisms. These can be operated separately or disconnected if desired. This all-purpose pilot plant filter is available to you on a unique rental-purchase plan, requires no capital investment. Ask for details.

If it's a relatively free-filtering job, such as a coarse crystalline or fibrous pulp, try the simpler FEinc Horizontal Filter first. Particularly good for counter-current or multiple-stage washing. Only 3 ft. dia., with amazingly high output.

Whatever your problem, if it's continuous filtration, talk to FEinc first. Our engineering service is backed by 35 years of experience, and by our well-known ability to deliver filters that are tailor-made to fit the job . . . at no more than standard costs.



Ask for Bulletin

#### Filtration Engineers, Inc.

CUSTOM DESIGNERS AND MANUFACTURERS OF ALL TYPES OF CONTINUOUS FILTRATION EQUIPMENT FEinc

44 155 ORATON STREET . NEWARK 4, N. J.

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touch with what they re of	uerin
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Apply pressure to the outside edge of the valve member with a pencil point. Notice how it tilts and opens with a light pressure, without noticeable friction.

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Now try this with an ordinary valve. If the valve opens at all, it will only open part of the way, and with excessive friction.

All reciprocating pump valves are subjected to flow forces which necessitate tilting of the valve member while opening. In applying pressure through the seat with a pencil point to the outer edge of the valve member you approximate operating action.

mate operating action.

In a DURABLA Valve only "point contact" is made by the valve member on the stud or sleeve, so it cannot bind or hang-up on the guard stem, but opens with a tilt-action following the flow line. Other types of valves using wings for seat guiding or high hubs for stem guiding, cannot avoid creating excessive wear and friction, with resultant warpage and possible breakage of valve or stud.

The unique DURABLA Stainless Steel Valve will operate freely under extremes of high or low temperature, with highly corrosive fluids, and in any position. It will handle vacuums of one micron or discharge pressures of thousands of pounds per square inch. Standard equipment on many pumps, it will fit ANY pump, old or new. Ask for bulletin MF-125.



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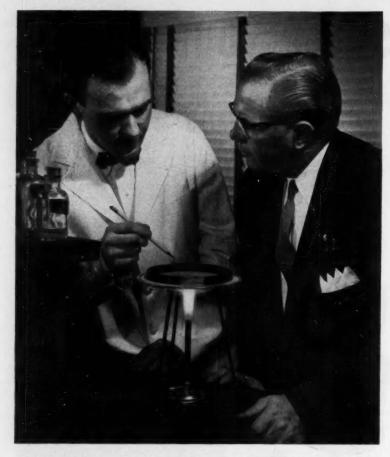
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#### Editorial Reprints . . .

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128 pp. of data (\$1.75).

128 pp. of data (§1.73).

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#### BOTTOM DISCHARGE Plus center-slung SUSPENSION

unloads fast This new Tolhurst Batch-Master Centrifugal discharges solids through the bottom in seconds . . . saves unloading time . . . speeds up production cycles. In fact, it's the fastest unloading centrifugal there is. The bottom opening is 25% larger than on any other

handles unbalanced loads Batch-Master is constructed with Tolhurst's exclusive "Center-Slung" design. The points of suspension on the case are in a plane which passes through the center of gravity of the rotating basket and load. This reduces the overturning effects of unbalanced loads and allows the rotating mass to find its own center of gyration. Thus "Center-Slung" centrifugals handle 3 to 4 times greater out-of-balance loads than ordinary machines. So Batch-Master runs smoothly - with vibration largely eliminated, bearing stress relieved.

Sizes are 40" and 48" . . . in choice of corrosion-resistant materials . . . perforate or imperforate baskets. Send for full data.

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Send data on new Batch-l	Master.
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#### Lasts at least 3 times longer than ordinary pump packings

Frankly, the service reports on LATTICE BRAID asbestos packing with Teflon surprised us! Originally designed and test-proven for use against severe acids, caustics, and other chemicals, this particular packing has out-performed other packings (even our own) on more common applications against water, steam, solvents, and oils.

And here's why: (1) The LATTICE BRAID construction gives greater strength; (2) The Teflon core and heavy Teflon impregnation resist everything except molten alkali metals and some freons; (3) It does not adhere to the shaft or rod; (4) It runs smoother and freer than packings without Teflon.

Check these typical service reports:

· Against blending waxes and steam (for cleaning).

it outlasted another Garlock style 10 to 1 Against caustic at 325°F., 50 p.s.i., it outlasted competitive packing 38 to 1

Against cold water, it out-performed other packings 3 to 1

LATTICE BRAID with Teflon is available in either Canadian white asbestos (style 5861) or blue African asbestos (style 5880). Each is furnished in packing sizes 5/16" to 11/2" graduated by sixteenths.

Try an order of 10 feet or more today. Chances are you can reduce down-time, maintenance and replacement costs to one-third of their present amount.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK Seles Offices and Wershousers Baltimore \* Birmingham \* Boston \* Buffalo Chicago \* Cincinnati \* Cleveland \* Denver \* Detroit \* Houston Los Angeles \* New Orleans \* New York City \* Palmyra (N.Y.) Philadelphia \* Pittsburgh \* Portland (Oregon) \* Salt Lake City \* San Francisco \* St. Louis \* Seattle \* Spokane \* Tulia.

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GARLOCK LATTICE BRAID

with TEFLON



Here's your answer if you have the problem of getting accurate level readings of liquids that boil or surge or liquids that are heavy and don't flow at normal temperature. Jerguson Heated and Cooled Gages are specially designed and built to carry a cooling circulating medium to control boiling tendencies . . . or a heating circulating medium to speed the flow . . . so you get accurate readings. These gages are also ideal in cold weather applications for they can be heated to prevent gage freezing and breakage.

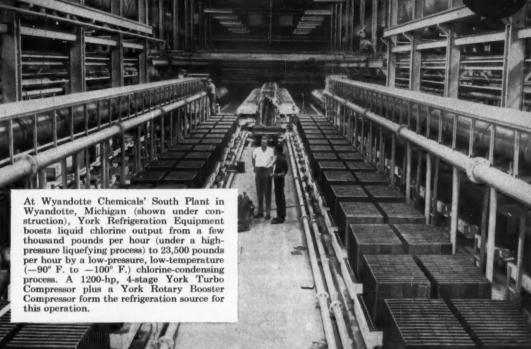
Jerguson's high standards of design are followed throughout; and materials are selected to exceed or conform to A.I.S.I., A.S.T.M. and/or A.P.I.-A.S.M.E. requirements. Available in external or internal tube models, reflex or transparent types, in a large number of sizes and pressure groups.

You'll get rid of the troublesome problems involved in steam tracing and won't have to insulate gages or valves, you'il eliminate the problem of getting accurate level readings of hot or cold liquids, and you'll cut maintenance hours and costs with Jerguson Heated and Cooled Gages. Send for detailed Data Unit and full information.



## **Chemical Plants**





MORE LOW-TEMPERATURE PROCESSES TO-DAY—and whether you need dependable, constant-capacity refrigeration on a 24hour, seven-day-week basis, or have an application where refrigeration loads will fluctuate, York Turbo Compressors will do the job.

LOW-TEMPERATURE PROCESSES HAVE TRENDED LOWER—and York Turbo Compressors provide efficient operation in low-temperature processes down to -125° F. (using "Freon-12").

FLOOR SPACE AT A PREMIUM—and a single York Turbo Compressor may fill all your refrigeration needs. York makes Turbo Compressors (in single- and multiple-stage models) up to 3000 tons capacity with Freon refrigerants. (Models also available for ammonia and hydrocarbon

refrigeration duty and for general gas compression service.)

CHOOSE YOUR POWER SUPPLY—York Turbo Compressors may be driven by A.C. or D.C. electric motors, either constant or variable speed, steam turbines or internal combustion engines. You choose the power supply that is most economical for you.

EXTREME FLEXIBILITY—even where constant-speed drive is used, York Turbo Compressors, with their exclusive Pre-Rotation Vanes, permit efficient operation over wide ranges of capacity, using either automatic or manual control.

experience in the centrifugal compression field is part of a complete York service available to your design engineer.

#### Some Helpful Hints for Chemical Men

1. To block radiant heat from motors near hot equipment, circle the motor with a fine-mesh screen similar to that in the masks worn by steelworkers near hot operations. Leave the ends open to keep normal circulation.

2. A quick, easy way to seal small leaks in vacuum or low-pressure systems is to melt a piece of polyethylene tubing around the leak. This forms a corrosion-resistant seal which can easily be removed by burning or cutting.

3. To increase the life of wooden pallets, bands of steel should be stapled under tension around the pallet. The bands should circle the pallet and go under the runners. This will prevent distortion and splitting of the pallet and keep the nails anchored.

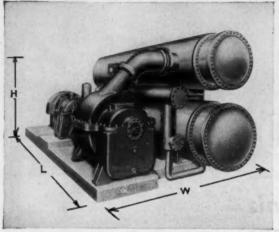
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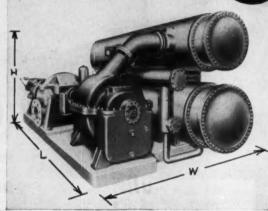
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CUT

## YORK TURBO COMPRESSORS







MOTOR DRIVE

STEAM TURBINE DRIVE

ALONG

York Freon Turbo Compressor Systems are particularly adapted to high-capacity refrigeration loads. Their inherent ability to handle large gas volumes permits maximum capacity per unit of floor area, while their vibration-free design permits installation in any convenient location—even on upper floors. These characteristics insure a highly compact and economical installation.

#### DIMENSIONS

(Depending on model chosen)

Type	"L"	"W"	"H"		
Motor Drive	14'6" to 20'9"	9'9" to 15'10"	6'8" to 12'8"		
Steam Turbine Drive	14'6" to 16'0"	9'9" to 15'10"	6'8" to 12'8"		

NOTE: Dimension "L" will vary with type and size of motor and gear, or with type of turbine. All dimensions are based on 2- and 4-pass shells. Purge device adds 21' to overall "W" dimension.

#### PRINCIPAL (AND EXCLUSIVE) FEATURES



IMPELLER. Blades, hub and cover discs are made entirely of stainless steel—impeller blades successfully resist erosion...the entire wheel resists corrosion—assuring perfect wheel balance during service life. Blades are end milled to form integral rivets, eliminating heads and resulting in unobstructed gas flow and noise abatement.



PRE-ROTATION VANES for maximum capacity reduction. Capacity control is accomplished by changing direction of the rotation of suction gas entering the first stage wheel, thereby changing the characteristics of the wheel. Each change produces the same results as a separate machine of smaller size.



SIMPLIFIED REFRIGERANT SHAFT SEAL prevents gas leakage. Sealing is accomplished by two stationary carbon rings kept always in contact with the shaft seal ring. Seal surfaces are accurately finished and sealed with oil from the compressor lubricating system.



THRUST ABSORBING BALANCE DISC CUTS FRICTION LOSSES. Unbalanced shaft thrust caused by unequal gas pressure on opposite faces of each wheel equalized by balance disc. Need for a heavy duty thrust bearing with attendant higher friction losses eliminated.

York Corporation, York, Pa.



the quality name in refrigeration

HEADQUARTERS FOR MECHANICAL COOLING SINCE 188

## ACCELERATION COLLISION IM PLOSION

#### in a Gaulin Homogenizer makes many products better - more economically

A Gaulin Homogenizer does three very important things to a product - it shears, expands and explodes, agglomerates down to their ultimate particle size.

The results of this particle acceleration go far beyond just making products uniformly finer, faster, more economically. In most cases, the physical characteristics of a product are modified.

For example, here are some typical property changes. A Gaulin will stop separation. Accent taste, scent, and color. Improve texture, flow lubricity. Speed chemical reactions, and dispersion of ingredients. And reduce the amount of expensive materials needed.

#### How about your product?

We'll be glad to show you just how a Gaulin can improve your product — and work with you toward solving any specific problems you may have. Write today for more information.

MANTON-GAULIN MFG. CO., INC., 71 Garden Street, Everett 49, Mass.

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Some Typical Products Improved by Gaulin Homogenizers

#### PHARMACEUTICAL

Emulsions and dispersions. Gaulins make them stable, uniformly finer. Permit accurate reproduceability.

#### LIQUID STARCH

Improves transparency, clarity, and stops separation, at lower cost than other methods.

#### GREASE

Improves lubricating value and stability. Increases service life.

#### PIGMENT DISPERSIONS

Provides continuous high capacity producing dispersions of ultimate particle

#### COSMETIC EMULSION

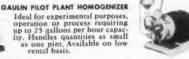
Gives smoother texture, longer shelflife. Locks in perfume against evaporation.

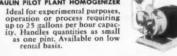
#### WAXES

Makes accurate reproduceability possible. Provides uniform, stable emulsions and convenient viscosity control. Increases gloss.



Stator is jacketed for cooling or heating. Gap setting adjustable for .001" to .045". Only 45 seconds clean-up required in changing colors. 12" head room. 12" x 17" floor area.









#### HOMOGENIZERS

WORLD'S LARGEST MANUFACTURER OF HOMOGENIZERS, TRIPLEX STAINLESS-STEEL HIGH PRESSURE PUMPS, AND COLLOID MILLS



This nickel-clad steel tank processes essential oils, was designed to operate at 100 psi. pressure.

SOLID HIGH-ALLOY PROTECTION

AT LOWER COST

Where protection from corrosion, abrasion, and forms of product contamination such as metallic pick-up is a "must", clad steel equipment is often the *economical* answer. Under pressure, vacuum or thermal cyclical service, the high-alloy cladding will not tear away nor will bond failure permit liquid seepage between cladding and backing. If processes change, equipment modifications can be readily made without injuring the clad surface or bond. The smooth contours and joints possible with clad mean easy cleaning and low maintenance, too.

Why pay a premium for protection in your new processing equipment? Lukens Clad Steels—stainless, nickel, Monel, Inconel, copper—give you all the advantages of

these solid high-alloys with savings up to 50% in material costs

When you're thinking of new tanks and vessels, qualified equipment builders can assist from the earliest stages of planning. Working with your engineers and consultants, they know how to help minimize first cost and assure trouble-free equipment life with clad steel. We offer the widest range of clad steels available and work closely with fabricators to help select the type most suited to your processing needs. If you would like further information, ask one of your builders or write Manager, Marketing Service, Lukens Steel Company, 750 Lukens Building, Coatesville, Pennsylvania.



## **CLAD STEELS**

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE

## White your own ticket -

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SERIAL		STYLE
TYPE	FRAME V	H.P.
VOLTS	~	CYCLES
AMPS.	~	PHASE
R.P.M.	~	SERVICE FACTOR
CODE	TEMP.	
*SP	V	
	MANUFACT	URED BY
THE 62916		CO., DAYTON, O., U.S.A.

What are your power drive requirements? Here at Master, with the widest selection in the nation to choose from, you're sure to fill your needs quickest and best.

Need something special in gear reduction—electric brakes—variable speed operation—fluid drive or special mounting? Or would some of our standard models (1/8 to 400 H.P.) fill the bill? You'll find the answer here! And remember, all Master components are engineered to form combinations of units in one streamlined, compact package of efficiency. Name your need and the name that fills it is Master—for greater salability of motor driven products; for increased productivity of plant equipment.

Motor Ratings...1% to 400 H.P. All phases, voltages and frequencies.

Motor Types.....Squirrel cage, slip ring, synchronous, repulsion-start induction, capacitor, direct current.

Construction ....Open, enclosed, splash-proof, fan-cooled, explosion-proof, special purpose.

Speeds ............Single speed, multi-speed, and variable speed.

Installation ......Horizontal or vertical, with or without flanges and other features.

Power Drive Electric brakes (2 types)— 5 types of gear Features ....... reduction up to 432 to 1 ratio. Mechanically and electronically-controlled variable speed units—fluid drives—every type of mounting.

THE MASTER ELECTRIC COMPANY DAYTON 1, OHIO



## Corrosioneering News





## What Progress **Against Corrosion** in 1955?

A top-level report by DONALD A. GAUDION

Vice-President, The Pfaudler Co.

How big a problem is corrosion? Some sources tell me it costs industry about six billion dollars a year. In petroleum alone, every

barrel of crude oil processed eats up 9¢ worth of equipment.

And with today's trends toward higher pressures, higher temperatures, continuous processes, you can expect corrosion to step up its at-

tack on your equipment.

At Pfaudler, we traffic in corrosion-resistant equipment. Our specialty is a material called "glassed steel"- acid-alkali-resistant glass, permanently fused to steel, to give you the corrosion resistance of glass plus the structural strength of steel.

At the same time we have developed a broad knowledge of corrosion-resistant alloys, like Hastelloy, inconel, monel; the stainless steels; aluminum; copper; titanium; and synthetics, such as Teflon and

Guarantee against corrosion

Several innovations appeared, to help you lick corrosion. A hitherto unheard of guarantee was given: No corrosive destruction for 12 months on Pfaudler glassed steel

We also introduced a new glassed steel dryer-blender . . . Bigger reactors in money-saving standard designs . . . New nonmetallic seals for agitators on reaction kettles... New glass Turbogrid column trays ... and other new or improved units.

While our research crew probed the future, we also added greatly to our knowledge of corrosioneering by examining reports from users of Pfaudler equipment over the past year. For example, we learned that, in 28 installations, our "packaged" system for plating acid recovery usually paid for itself in 6 to 12

More engineering services

To further help you with corrosion problems, we revamped our technical staff, adding a new Applications Engineering Group. You can add their experience to yours whenever you are faced with special projects. They can "take over" if you want them to.

Corrosion Seminars

To increase general knowledge of new developments, we conducted four Corrosion Seminars during the year. Also, technical talks and articles were delivered by Pfaudler people. In research, we have continued our scholarships at Ohio State, Rochester, and Penn State Universities, Rochester Institute of Technology and Rensselaer Polytechnic Institute.

To you, who must pay the bill for corrosion, we believe these progressive steps are significant and worthy of your investigation. Meantime, we are searching daily for new approaches, and will report frequently to you on the pages of this publi-



THE PFAUDLER CO., ROCHESTER 3, N.Y.